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The
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SMOKE RINGS

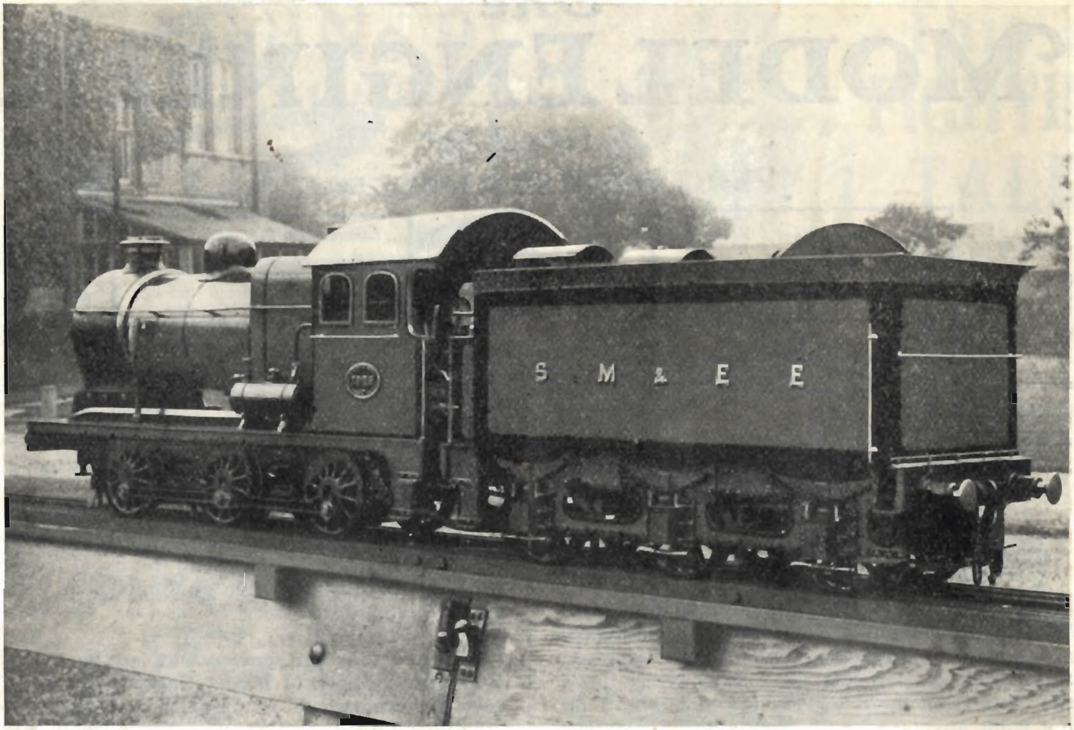
I WANT to remind all intending Exhibition competitors that their entry forms should be filled in and returned to us not later than August 24. Holidays and other outdoor distractions at this period of the year are apt to divert one's thoughts from more serious matters, and I do not want anyone who has vistualised September in his mind as the time to do things to wake up and find that he has allowed the closing date for entries to slip by. We have already had a number of very interesting entries sent in, and applications for forms are still arriving. There is no doubt that there will be a very good show of work this year, and I hope this reminder about the closing date will bring back to us a number of the forms still outstanding. A pleasing feature of this year's show is a determined desire on the part of all the clubs to put up a better display than ever. I think the effort of the Society of Model and Experimental Engineers will surpass anything they have done before. Not only will they give their customary demonstrations on the running track, and make a fine show of the general model-making work of their members, but they will run a workshop in which model-making demonstrations will be regularly given. This will not only interest the visitors very much, but will serve to illustrate the very considerable range of mechanical ability in the ranks of the Society's membership. The model railway, boat, and aeroplane clubs are all on their toes to make a worthy display, and I am sure that the social and co-operative side of model engineering will be more efficiently represented this year than it has ever been before. There will be some specially fine exhibits in the trade section, some good loan models, and some attractive side-shows. We have an excellent poster in the printer's hands, and I shall be glad to send copies to any of my reader friends who can extend the usual friendly display to this attractive announcement of the Exhibition.

* * *

I hear that the power-boat section of the Glasgow Society of Model Engineers is on the eve of development. A regatta is projected for the near future, and some excellent trophies and other prizes for competition have been promised. The Clyde is famous the world over for its shipyards; it ought to be equally famous for its model ships and its model power boats. The hon. secretary is Mr. J. Lindsay, 105, Calder Street, Glasgow, S.2; he will be pleased to hear from any local power boat men who have not yet joined up, and I hope he will find plenty of support forthcoming in this direction. Running model boats in company with other enthusiasts and the consequent exchange of ideas and experiences adds tremendously to the pleasure of the hobby, to say nothing of the sporting possibilities of trying to beat the other fellow's boat round the pole or in the steering competition.

* * *

By the courtesy of Mr. J. N. Maskelyne, A.I.Loco.E., who took the photograph, I am able this week to give the promised picture of the new "Club" locomotive of the Society of Model and Experimental Engineers. Mr. Hart, who has had much to do with the successful completion of the model, kindly gives me the following details: Cylinders $1\frac{1}{4}$ ins. by 2 ins., wheels (six-coupled) 4 ins. diameter, boiler 340 sq. ins. heating surface, grate area $3\frac{1}{2}$ ins. by $6\frac{1}{4}$ ins., pressure 90 lbs. per sq. in., gauge 5 ins., general scale 1 in. to 1 ft. The feed is provided for by an axle-driven pump, and a steam donkey pump. The engine was originally planned as a tank engine, but was eventually converted and finished as a tender engine. It



The Joint Work of some of the Members of the Society of Model and Experimental Engineers.

has a rather marked resemblance to the "1100" class of the G.E.R., and though not definitely modelled on this prototype, the G.E.R. engine served as a partial inspiration when details and fittings were being discussed. As I reported last week, the engine is a sturdy job and a good worker. It will make a public appearance at the Exhibition and should be looked for.

* * *

Mr. Edward Robertson, of 131, River Street, Brechin, N.B., writes me that he is going to send a model loco to the Exhibition, which, he modestly states, is being entered not as a scale model but as the work of a "lonesome plodder." He has only one model engineering friend in his district, and between them they have got a nice little workshop together including a 3½-in. Drummond lathe, a 2½-in. lathe, a home-made drilling machine, and an emery grinder. He says it has been a bit of a struggle getting the tools together, but adds, "It is all for the cause and we never regret it." That is the spirit in which good model engineering is done, and I like to hear about it. Mr. Robertson would like to meet any other model engineers who may be within reach of his home. Nowadays when motor-cars and motorcycles make distances almost negligible, lonely model-makers ought not to be quite so lonely. It is a very sound reason for getting out the car or bike to run over somewhere to pay a friendly call on a brother model engineer, so I hope Mr. Robertson will have the pleasure of an occasional "crack" with a fellow enthusiast.

* * *

Model power boat men will notice in this issue the rules for the revised MODEL ENGINEER Speed Boat Competition for the current year. One or two modifications in the conditions are introduced, which we think will add to the interest of the competition and raise the standard of performance. It remains as before a purely "speed" contest, and no special provision is made for the "displacement" class of boat as compared with the hydroplane class. We realise, however, the desire of many boat enthusiasts that a contest should be organised for "displacement" boats, and we are considering such an event for the near future. The drafting of suitable definitions and conditions for these boats to please all possible competitors is not an easy task, as may be gathered from the diverse opinions recently expressed in our pages, but we hope a reasonable set of rules may shortly be arrived at.

Percival Marshall

LOCO. PROTOTYPES NEWS and NOTES

By Chas. S. Lake, A.M.I.Mech.E., M.Inst.L.E.

Factors in Locomotive Design.

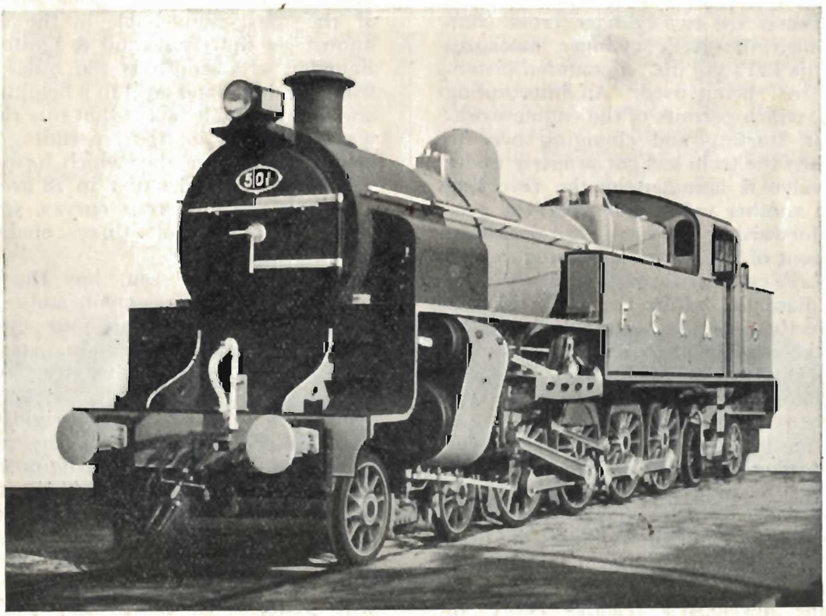
A correspondent who aspires eventually to become a locomotive engineer, and who is shortly to enter upon a course of training to that end, enquires as to what are the leading factors in connection with locomotive design, or, in other words, how is the designer guided in the selection of proportions and characteristic features of the locomotive.

One of the outstanding factors is, of course, that of the work to be performed and the character of the railway over which the engine will run. If it be assumed that an express passenger locomotive of a new type is to be built to meet specified performance conditions, something in the nature of an average must be struck so that the engine may accommodate itself as well as possible to the varying conditions of load and speed. Some considerable portions of the journey may be on the level, whilst at other points grades of varying intensity have to be negotiated, and where a change of engine is impracticable the same one must obviously be relied upon to work with efficiency under both sets of conditions.

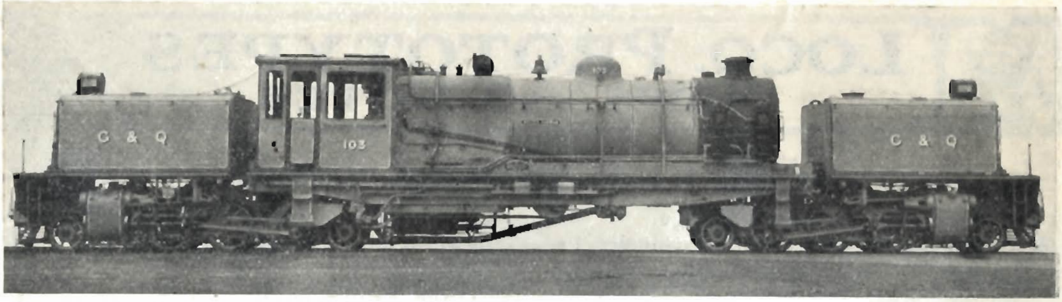
In steam locomotive practice it is not the same as in internal combustion or automobile practice, in which latter gearing is to a large extent relied upon to vary the power output of the engine. The steam locomotive relies on the elasticity of the steam and its ability to provide for a wide range of expansion in order to meet the demands made upon it for propulsive energy, and the designer has therefore to provide a boiler of adequate capacity to supply the steam, not forgetting that storage space is a matter of importance, and ensuring for the free circulation of the water and good steaming qualities.

Next, the cylinders must be of adequate volume so that the requisite tractive power is obtainable. The coupled wheels must be so proportioned that whereas on the level the engine can reach high speeds economically, the diameter must not be excessive, otherwise the climbing abilities of the locomotive will fall short and the average speed on the hilly section be impossible of maintenance.

In freight service, the problem is somewhat different, for there speed is not a main consideration. A freight locomotive must be able to deal with very heavy loads and overcome considerably augmented starting difficulties, whilst in



4—8—4 Compound Tank Locomotive for the Central Argentine Railway Co.



Garratt Locomotive for the Guayaquil & Quito Railway, Ecuador.

designing the boiler and firebox the fact must not be forgotten that such engines have to remain stationary for long periods, which has a decided effect upon the grate action and the general performance of the boiler. Wheels of small diameter must be used, and their number, for the heaviest work, increased so that a larger proportion of the weight of the engine is available for adhesion.

The boiler pressure is, of course, a matter of outstanding importance, as the higher the pressure the greater the tractive power, and, generally speaking, more use can be got out of a given weight of steam than where the pressure is lower.

A New Compound Tank Locomotive.

Ten compound tank locomotives of the 4—8—4 type have just recently been completed by Sir W. G. Armstrong, Whitworth & Co., Ltd., to the order of the Central Argentine Railway Company. These are two-cylinder cross compounds in which the H.P. cylinder measures 22½ ins. and the L.P. 31½ ins., a common piston-stroke of 26 ins. being used. An intercepting valve is fitted, which permits of the engine working simple at starting and changing over to compound when the train has got properly under way. This valve is actuated by the reversing gear through another valve, and when the gear is in the full forward or full backward positions, a certain amount of live steam is allowed to pass direct to the L.P. cylinder through a pipe of relatively small diameter, whilst the H.P. cylinder exhausts directly into the atmosphere. On notching up the valve gear, the live steam supply to the L.P. cylinder is cut off, as is also the exhaust to atmosphere of the H.P. cylinder, the locomotive then working as a compound.

The valve motion is of the Walschaerts type specially planned, as is also the capacity of the receiver, to ensure that the work done in the two cylinders is as nearly equal as possible. Piston valves placed above the cylinders are used for steam distribution, these having a travel of 8 ins.

Each engine develops a tractive effort of 25,500 lbs. at 60 per cent. of the boiler pressure. They are intended for handling suburban passenger traffic, and when thoroughly run in they will also be used for goods traffic. The eight-coupled wheels have a diameter of 5 ft. 2 ins., the second and intermediate pair being flangeless.

The heating surface of the boiler is 1,600 sq. ft., and the superheater 277 sq. ft., a combined total of 1,877 sq. ft. The grate area is 27.9 sq. ft., and boiler pressure 200 lbs. per sq. in. In working order the engine weighs 110 tons 4 cwts. with 63 tons 1 cwt. 1 qr. available for adhesion. The gauge of the railway is 5 ft. 6 ins.

An Interesting Garratt Locomotive.

There have recently been completed at the works of Beyer, Peacock & Co., Ltd., three Beyer-Garratt locomotives of interesting design, built for service in South America, one of their number being illustrated herewith. The railway over which these engines will work is one of the most remarkable in the world. It is known as the Guayaquil & Quito Railway of Ecuador. Its length is 280 miles, and it rises from the delta land level to a height of 11,841 ft., and a remarkable fact is that this railway, which was completed in 1908, permits of a journey being made in one day which formerly occupied a fortnight. Grades of 1 in 18 are encountered and there are numerous curves, some of which have a radius of three chains and are uncompensated.

The engine, as seen, has the 2—6—2 + 2—6—2 wheel arrangement, and is built for the 3-ft.6-in. gauge. It has four cylinders, each 15½ ins. diameter by 20-in. stroke, coupled wheels 3 ft. 2 ins. diameter, total heating surface, with superheater, 2,338 sq. ft., and grate area 40.4 sq. ft. The rigid wheelbase of each group is 17 ft. 1 in., and the extreme wheelbase 57 ft. 5 ins. In working order the engine weighs 120 tons 7 cwts., and it develops a tractive force, at 75 per cent. of the boiler pressure (200 lbs. per sq. in.) of 37,930 lbs. The engine is elaborately equipped and very strongly built. The railway over which it works is laid with 55-lb. rails, except on certain mountain sections, where 70-lb. rails are used.

SHOPS SHED & ROAD

A Column of "Live Steam."

By "L.B.S.C."

Mr. Gray's Victorian 4—6—2.

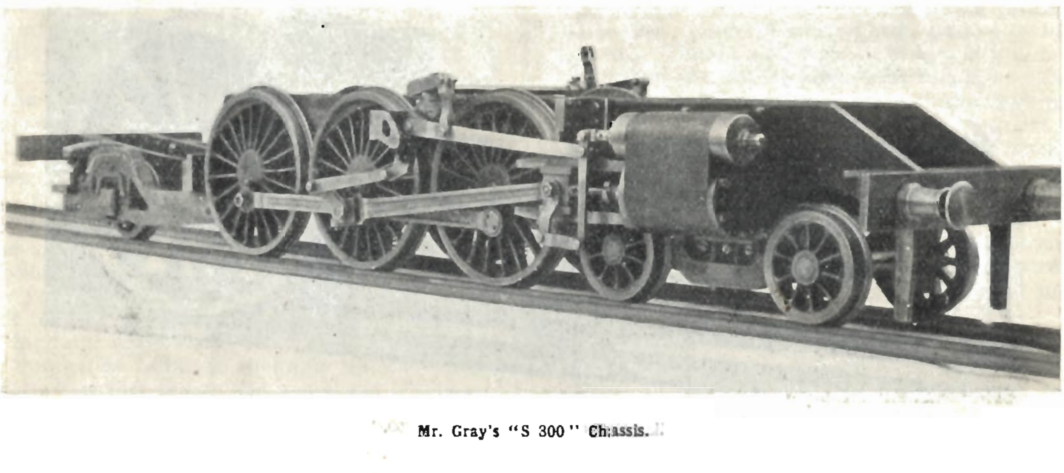
Mention was made some time ago of Mr. Austin Gray's Australian Pacific, and a picture of the inside of the boiler was shown in these notes. Here are two more photos showing the chassis. The engine is a copy of one of the S300 class three-cylinder engines, and while retaining the chief features of the big sister, the little one has been altered in many details to suit $2\frac{1}{2}$-in. gauge. At present she has two cylinders only, but Mr. Gray says he has made provision for the third and will fit it later on if she proves satisfactory. The two fitted are $\frac{3}{4}$-in. bore and $1\frac{1}{8}$-in. stroke.

The chassis appears to be sturdy and well built, following the usual run of $2\frac{1}{2}$-in. gauge practice, except for the trailing frame and truck, which is arranged in a very ingenious way. On my Pacifics I sometimes fix up the pony truck pivot on the ashpan, which is plenty strong enough to stand it, so that the whole lot comes away easily when the firebox wants cleaning out. Mr. Gray has improved on that stunt by arranging the whole issue—trailing frames and all—to come away by just taking off two 3/16th-in. nuts and pulling the whole lot clear; see photo of trailing end.

Another point of interest is the back suspension, which is really the big engine's arrangement simplified. The brackets on the trailing frame bear on rockers, curved at the top and pivoted to the cross tie of the pony truck. Mr. Gray says they work quite well and are easy to make. The picture of the trailing end shows all details very well, so no further explanation is needed. This type of suspension is common on many American and Colonial engines, and may be used on small copies of British and Continental engines which have a pony truck instead of a radial axle. I much prefer the pony truck, as most miniature roads have sharp curves which are a bit more than any radial axle cares to tackle with speed and safety.

A Few Dimensions and Remarks.

The driving wheels are $3\frac{1}{4}$ ins. diameter, and the bogie, trailing and tender all $1\frac{5}{8}$ ins. The boiler is $3\frac{1}{2}$ ins. diameter and the combined firebox crown sheet and top of combustion chamber is equal to the length of tubes, viz., 8 ins., which is correct practice. There are twelve $\frac{3}{8}$-in. fire tubes and two $\frac{5}{8}$-in. superheater flues, also five $\frac{1}{2}$-in. water-tube struts in the combustion chamber. Mr. Gray says he was unable to procure $\frac{3}{8}$-in. tubes of less than 20-gauge in Australia, so imported some 26-gauge specially for the job. The firebox sheets are made from 14-gauge plate, as Mr. Gray wants to use high pressure and believes in "safety first." As he says, the plates will take more initial heating, but the large tube-heating surface and the water-tubes in the combustion chamber will even things up. It is, of course, a matter for experi-



Mr. Gray's "S 300" Chassis.

ment, but I guess she will work all right. I usually find that a well-made loco-type boiler will produce all the steam required from it, even if it be at the expense of a little forcing. Anyway, I would rather see a $2\frac{1}{2}$-in. gauge boiler made from 14-gauge plate throughout than one with castings in it; the latter fail too often, and choose the time when you least expect it. Mr. Gray finished his cheery missive by saying that he didn't mind building a boiler or chassis, but erecting and piping up gets him down. I guess he's not the only one! Somehow it seems an interminable time between finishing the bits and getting them all together; the engine seems as though she is never going to take the road, you develop that "so near and yet so far" feeling, and if the weather has been anything like the middle of July, 1929, the average loco builder side-tracks the whole issue and sallies forth in search of a swimming bath.

Mr. Kennion's "Articulator."

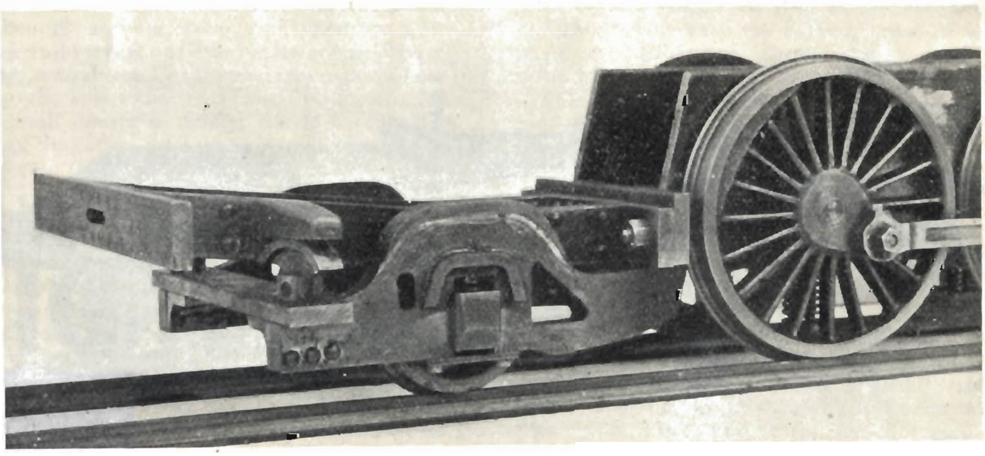
This engine, which Mr. Marshall mentioned in his "Smoke Rings" when giving an account of Mr. Gerson's garden party, recently paid a visit to the N.L. for test purposes, and whilst she was here, friend "Bill Massive" took a shot of her, as you see. She is a "massive" sort of a job, if ever there was one; I don't know who built her, but he certainly put plenty of painstaking work into her. As her name denotes, she is a "single-Fairlie" type articulated gadget, the eight coupled wheels being on a swinging frame which is further helped by a pony truck. The rear bogie is like that used on the old Caledonian tenders and is sprung and equalised. She is flexible for her great length, and ran around Mr. Gerson's curved road quite well. There is a big gap between main frames and trailing bogie which accommodates the outsize firebox.

The cylinders are very small for the size and type of engine, and Mr. Kennion is replacing them by a pair of 1-in. bore, which will boost up the pulling power very considerably. The motion is Stephenson link, which is not arranged as I would have it, and uses a lot of steam at present; however, friend Kennion will be able to correct that all right. The boiler is enormous, in fact, as big as my caterpillar, and has a wide-grate Belpaire firebox like the old G.W. "Great Bear." It has twelve tubes but no superheater flues—bad mistake that—relying on a coil in the smokebox for superheating purposes. As the builder put in a coil to get the necessary flexible cylinder connections required by the articulated frame, I guess he thought to kill two birds with one brick, but one of the birds has got away with it. She makes plenty of steam, however, so it doesn't really matter so long as the engineman doesn't mind plenty of "shovel and pump." The boiler is very well made, and is all brazed; has a dump grate and all the usual fittings. The working pressure is 80 lbs., easily maintained. A single mechanical pump is fitted which keeps up the water level, as it works pretty quick owing to the small wheels. There is an emergency hand pump in the bunker, of the "direct push" pattern.

The engine put up a fair performance on Mr. Gerson's line, but owing to a choked blower jet, didn't give of her best. However, on the N.L. she went fine, was never short of steam, and friend Kennion and myself took it in turns to drive her up and down for best part of an hour. She handled the load easily, and except for the heavy consumption, gave no trouble. When Mr. Kennion has fitted the new cylinders and tuned her up a bit, she ought to be champion.

"Unknown Factors"—Why Neglect the Obvious?

The article by "Ibn Chaffif" on page 40, July 11 issue, prompts one to ask why it is



Trailing Truck of $2\frac{1}{2}$-in. Gauge "S 300."

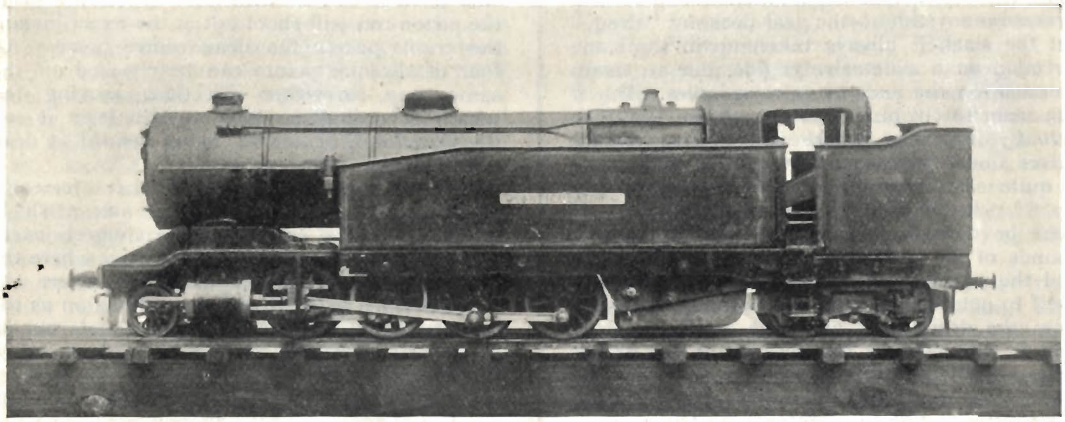


Photo by] Mr. Kennion's Articulated 2—8—4 Tank. [*"Bill Massive."*

that the "trained mind" is so apt to ignore obvious and commonplace facts. It *is* so; and not only the highbrow, but even the "ordinary" mind sometimes gets a slap with the same tar brush. Somebody with a stopped auto. engine fooled around for about two hours outside my front gate on a recent Sunday evening before discovering that the tank was empty; and another inadvertantly knocked off his ignition switch in the middle of Westminster Bridge and might have still been there if the traffic policeman hadn't come to the rescue. You get a similar state of affairs in every walk of life—I guess everyone knows about the absent-minded professor who searched high and low for his hat, whilst all the time he was wearing it. In loco work I know of an engine built by a firm to the designs of its chief engineer, who personally spent about seven weeks trying to get it to run with equal port openings and good distribution in both directions. A simple fact, staring him in the face, stumped him because he refused to recognise it. A friend tells me that "Ibn Chaffif" designs valve gears—I hope he didn't design that one, for he was right in saying that you have to experiment to find out, and I gracefully acknowledge his reference to the writer who discourses "with charming inconsequence." Well, as many brothers want information in "tuning up," let's see what we can do for them.

How to Tune Up a Locomotive—Bushes and Pistons.

The first thing to do before attempting any fine adjustments, is to go over the whole of the motion, from the axleboxes down to the pins in the valve gear, and see that there is *no undue slop* anywhere. Some joints need to be well fitting, and some loose; and one of the "arts" of locomotive fitting is to know "t'other from which," as the country lad would put it. Take, for instance, the coupling rods. The driving bush needs to be a nice running fit without shake; but the trailing bush, and the others as well in the case of a multi-coupled engine, must have just enough play to allow free movement in any position of the axlebox. Otherwise, if they are all tight, the rods will bind when the axleboxes move up and down on a bad road, or when running through frogs and switches. If they are all loose, she will knock and rattle. On a big 4—4—0, the trailing bushes are given 1/16th-in. clearance when new, and this is what causes the ring and clank when the engine drifts with steam off. Big-ends should not be too tight, but little-ends should be fairly close fitting. A general rule to observe is that all parts connected with the engine frame should be well fitted, and all parts connected with the wheels and axles should be easy.

Pistons should be a good fit and not rely on packing alone for tightness, otherwise it is liable to get blown off under heavy work. Packing should be merely a "seal" and not have to withstand great pressure; being so, there is no need to pack pistons so tightly that you can hardly turn the wheels. Most commercial engines have, unfortunately, poor fitting pistons with thin flanges and tightly packed wide grooves. These go all right at first, and it is not until after the buyers have written and told the makers how delighted they are with the working that they find out the "fly in the ointment." Who doesn't remember the epidemic of cheap lathe testimonials? But once they took the centres out—'nuff sed! *Re* Mr. Bamford's letter, a locomotive piston could not be made of the plug variety with labyrinth packing grooves, as this type should be of great length compared to diameter, and locomotive cylinders will not allow of it. Otherwise I agree with him.

Finding Admission and Cut-off Points.

I have had lots of correspondence on the subject of tuning up. Some brothers can't see why an engine should be all right when set "by sight," and yet all out when steam is on. Of

course, the principal explanation is one I have stressed many times—the gear does not "drag," but the slack is always taken up in the same direction on a slide-valve engine, due to steam pressure on the ends of valve spindles. But if you want to cut out all error and see *what she actually does* and where it happens, set all valves under pressure, either air or steam. It is quite easy, especially where the engine has drain cocks to each end of each cylinder. If these be opened, the engine jacked up, a few pounds of air pressure pumped into the boiler and the wheels turned by hand, it is simplicity itself to note whether the air commences to rush from the drain cock with the crank on dead centre, and whether it leaves off at the 75 per cent. cut-off point, which is, of course, when the piston has made three-quarters of the stroke. On a little engine there is no object in using a later cut-off, you only waste the steam. The exact point of cut-off—that is, when air ceases to issue from the cock—can be ascertained for any position of the reversing lever or screw gear, whichever is fitted. Try both directions (eight points in all), and adjust valve spindles if necessary.

With smaller engines which do not need drain cocks, all you want to do is to take off or disconnect the connecting rods, jack up and put air in the boiler as before. Push piston-rod right in, and slowly turn the wheels by hand, opening the regulator as front dead centre is reached. If the admission point is correct with lever in forward gear, the piston-rod will shoot out at the exact instant the crank passes the dead centre point. All four dead-centre points can be checked off the same way, in either direction, moving the wheels according to which way the lever is set, the piston-rod, of course, flying inward at dead centre on the return stroke.

To find the cut-off point, set lever full *forward*, push piston-rod right in, set crank a shade below *back* dead centre and turn wheels *backward* with regulator open. The point where the piston-rod shoots out is the point where she cuts off when going in the same direction as the lever is placed. If the piston-rod shoots out on back dead centre, or as soon as you come off it, then (providing the admission in forward gear is correct), she is cutting off miles late and requires longer valves and more advance.

In the case of engines with outside Walschaerts gear, where the main rod cannot be taken off without upsetting the return crank, take out the crosshead pin and let the rod hang loose, but replace the pin and recouple the union link in its original position.

Guess I ought not to say so, but the above method of setting timing is fine for the novice whose valve gear fitting is of the ragtime order, as it automatically allows for all slop everywhere, and by its aid I have temporarily put some ginger into machines which otherwise would have been out of commission until properly rebuilt. More about this next week.

AERO EXHIBITION AT OLYMPIA.

The seventh International Aero Exhibition held at Olympia, London, July 16 to 27, by the Society of British Aircraft Constructors, Ltd., was a remarkably good show.

A New Branch of Engineering.

The Exhibition impressed a view that in aircraft and the engines and extensive details of equipment is a new scope for designers, draughtsmen, artisans, manufacturers and a variety of trades. In addition, there is the design and construction of air ports and aerodromes, route lights, armament and other appliances of warfare and the development of auxiliary services. The design and construction of aircraft and engines involves aptitude to combine reliability and strength of parts with lightness. The tendency now is to supplant wood by metal in the framework and planes of aircraft; this requires a special degree of skill as well as a high standard in design and material. As examples there were a hollow main beam for an aeroplane on Messrs. Short Bros.' stand, about 50 ft. in length, a beautiful piece of riveted metal construction; the framework for the planes of a Handley Page machine and the Boulton and Paul system of light metal construction. There seems no doubt that a large industry will grow around aviation and have many ramifications.

Engines.

A very fine show in considerable variety, the famous Napier "Lion" and the Rolls Royce, the "Cirrus" four cylinders in line which seems popular for light aeroplanes; the "Salmson" Société des Moteurs Salmson, beautiful examples of mechanical work, in all twenty-six various makes of aero engines. The exhibit by the Bristol Aeroplane Co., Ltd., showed superb examples of Bristol "Jupiter," "Neptune," "Titan" and "Mercury" series, one being fitted with an epicyclic bevel reduction gear, the ratio being two to one.

Models.

Quite a feature of the show was the number of scale models used for illustrating types of aeroplanes by the various makers. These were of the commercial model kind giving an idea of general appearance and proportions, but nicely made and finished; they were on many of the stands and amply demonstrated utility of models for business purposes. Some were made of metal, a fine example being a model of the

flying ship type "Dornier" machine, fitted with twelve engines of 500 horse-power each; the wing span of the actual machine is 157 ft. 6 ins.; also a metal model of the "Dornier" racer twin-hull seaplane, two engines of 1,000 horse-power each, wing span 32 ft. 10 ins., speed 360 miles per hour. Messrs. Handley Page, Ltd., showed a working model demonstrating the action of "the slotted wing"; the British Air Ministry showed a working model demonstrating gyro rudder control and a panoramic view illustrating the development of flight, sixty-five models being suspended along the view, all made to a scale of ½ in. to 1 ft. The Italian Air Ministry exhibited a large model illustrating the "Benito Mussolini" Medical Institute for testing pilots: it showed the various rooms and their equipment; on this stand there were also models of a pneumatic chamber to test pilots for flying at high altitudes, models of aero-dynamic apparatus, Red Cross aeroplane, motor ambulance and a motor boat equipped and devised for transporting sick or wounded persons or effecting ready help in emergency. There were models of aerodromes and air ports and models in the inventions section.

Some Items of Particular Interest.

The "Cierva" autogiro was on view; this machine is remarkable by having a horizontal rotating windmill arrangement overhead. The vanes are not driven by power, they rotate freely by the action of the air as the machine moves. The object is to enable the machine to ascend and descend almost vertically, to ensure safety and prevent stalling. The present type is the outcome of some fifteen or sixteen previous experimental machines. An engine of about 80 brake horse-power driving a tractor propeller gives motion to the machine. It is essential that the windmill rotor is revolving before the machine ascends; this is accomplished by the air slip stream from the propeller, brakes being meanwhile applied to the carriage wheels. Particulars can be obtained from The Cierva Autogiro Co., Ltd., Bush House, Aldwych, London, W.C. The Rotary Aileron shown by Messrs. Glenny & Henderson, York Road, Byfleet, Surrey, fitted at the ends of the planes of a "Gadfly" light monoplane is a departure from the usual flap type aileron; it is claimed to give perfect lateral control. The "Fairey" gun mounting is a very facile mechanical device by means of which a machine-gun can be trained instantly to fire in almost any direction from an aeroplane cockpit. The ornithopter flapping-wing machine was in evidence by the "Hodson-Turner" on the inventions stand, and a machine was exhibited having rotary planes somewhat on the plan of the Flettner Rotor Ship arrangement.

Tuition.

Facilities for instruction in flying are increasing: the Brooklands School of Flying advertised a trial lesson for £1; Brooklands Aerodrome, Byfleet, Surrey. National Flying Services, Ltd., Grand Buildings, Trafalgar Square, London, W.C., advertised trial lessons at the London Air Park, Hanworth, for £2 2s., also short flights for 10s. to 25s., including free motor transport to and from Hanworth. Imperial Airways, every Friday and Saturday afternoons to September 28, advertised to take passengers for a 30 minutes cruise over London, tea being served during the flight, fare £2 2s. per passenger inclusive; Airways House, Charles Street, London, S.W.1, or any agent.

Huge Machines.

The "Vickers Victoria" troop carrier twin-tractor biplane, by Vickers Aviation, Ltd., accommodation for twenty-two soldiers and their rifles and kit, driven by two Napier "Lion" motors, 570 horse-power each; the "Singapore" boat seaplane for reconnaisance duties, two Rolls engines, 800 horse-power each, by Short Bros., Rochester, Kent; the "Handley Page Hare" day bomber; the Blackburn "Nile" monoplane type flying boat hull to carry fourteen passengers, three "Bristol" 490 horse-power engines; and the Ford tri-motored all-metal monoplane, to carry thirteen passengers, three Pratt & Whitney "Wasp" engines, 410 horse-power each were typical of a number of huge aircraft on view.

Societies.

The Royal Aeronautical Society, with which is incorporated the Institution of Aeronautical Engineers, staged an exceedingly interesting collection of old books, prints and announcement bills; one could have spent an afternoon examining and enjoying these. The Society also had on sale, price one shilling, a well-produced historical souvenir giving an account of its history with illustrations and matter concerning the development of ballooning and flying. Possibly some copies may still be available; the address of the Society is 7, Albemarle Street, London, W.1. The Society of Model Aeronautical Engineers had a capital exhibit of model flying aeroplanes comprising some of the latest ideas in design. The hon. secretary is Mr. S. H. F. Crouch, 23, Mayfair Avenue, Ilford, Essex.

Trade Models.

A good display by F. J. Mee, of 137A, Greenwich Road, London, S.E., of trade manufacture flying models varying in weight from ¼ oz. to 10 lbs. Included in a wide variety of appliances and accessories were fine examples of "lighthouse" type lanterns for route indication. There was scarcely any evidence of the small low-powered aeroplane desired or imagined by many of the uninitiated. The private owner machines of the "Moth" type seem to need an engine which will give normally about 80 to 100 horse-power for practical journeying; or at least about 35 to 40 horse-power for a single-seater. A good feature was the facilities provided and accessibility to the machines for examination and view by visitors.

MODEL COMPOUND STEAM ENGINE CONSTRUCTION.

Some Details of Methods and Processes Used in Making the Components.

(*Continued from page* 81, *vol.* LX.)

General Note.

In the issue of January 24 last, at and about the page given above, reference was made to the fact that Mr. Ballantyne had placed several important details in our possession to complete these notes on his compound condensing model. It is proposed now to refer to the design, construction and positioning of the sight-feed cylinder lubricator, which is a particular feature of the model, and has not hitherto been very clearly shown in any of the photos.

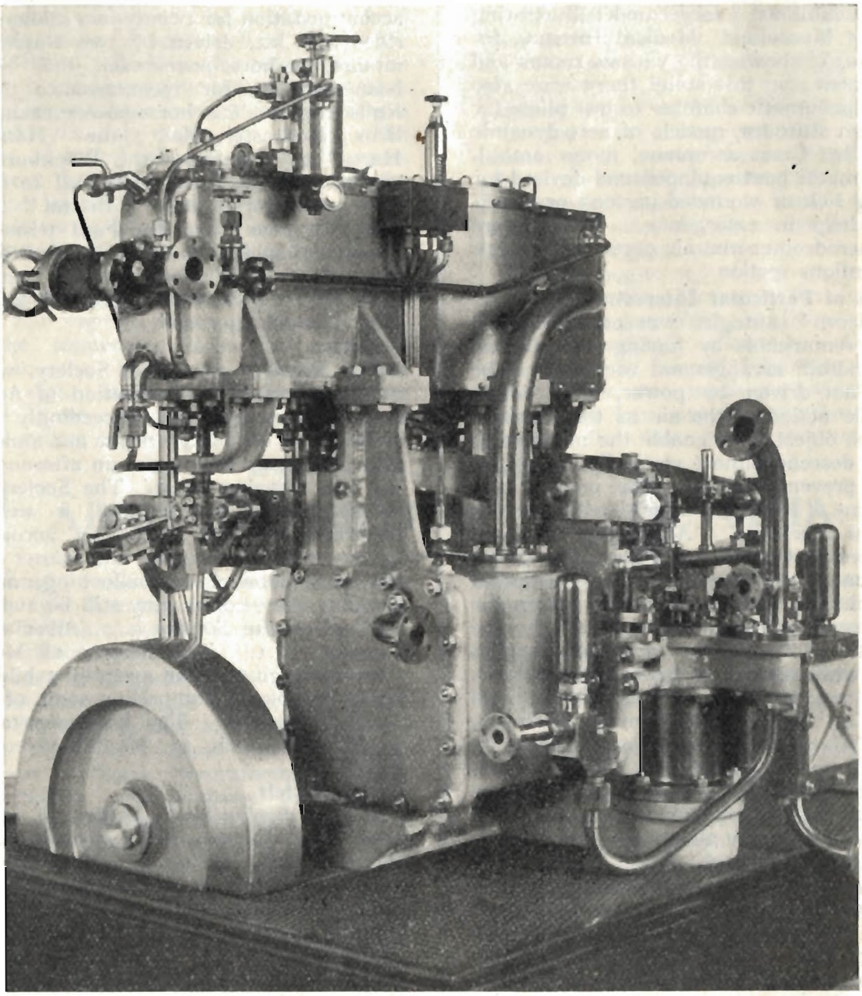


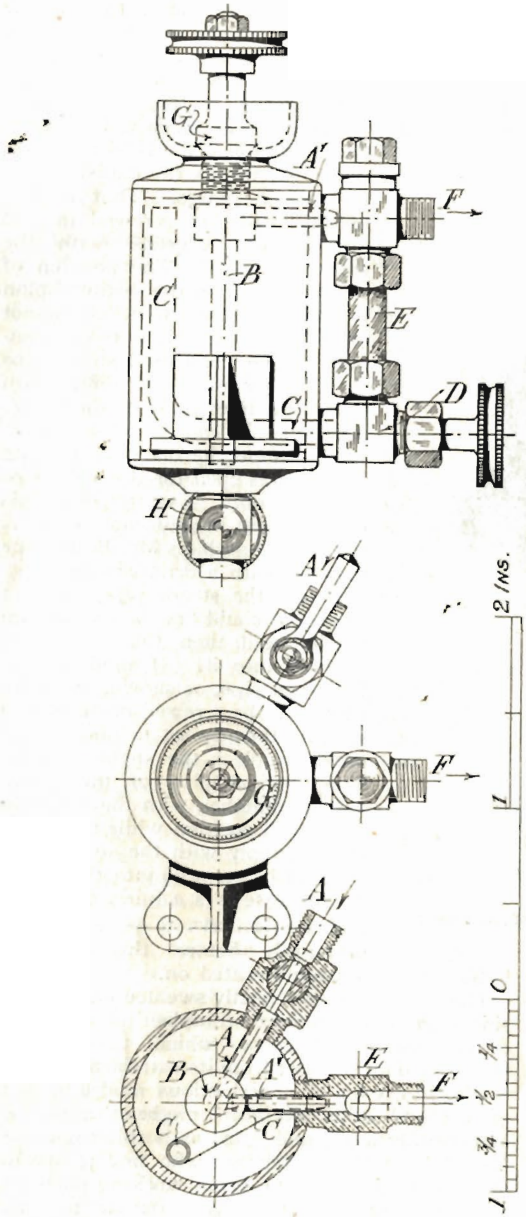
Fig. 1.—Three-quarter Back View of Model Compound Condensing Engine, indicating the Positions of Lubricating Arrangements.

The Sight-feed Lubricator and Reservoir.

A very fine three-quarter back view of the engine is seen in Fig. 1, which explains in clear detail the exact position of the cylinder sight-feed lubricator to the right, and the

reservoir oil feed for the motion work in centre. The latter has been referred to fairly fully and can be studied from this photo as further explanation.

As seen, the sight-feed lubricator is bracketed to the top of the high-pressure cylinder, at a point about midway between the top cylinder and top steam-chest covers. It is fed with steam from the top of a compound junction tee piece, flanged to the main valve on the steam side of same. The oil delivery passes from above the sight-feed tube down to the steam-chest cover. Fig. 2 is a closer view of the lubricator, in which the steam feed is seen to the top right, and oil feed pipe projecting to the left. The sight feed tube being to the left front below the union junction of the oil tube.



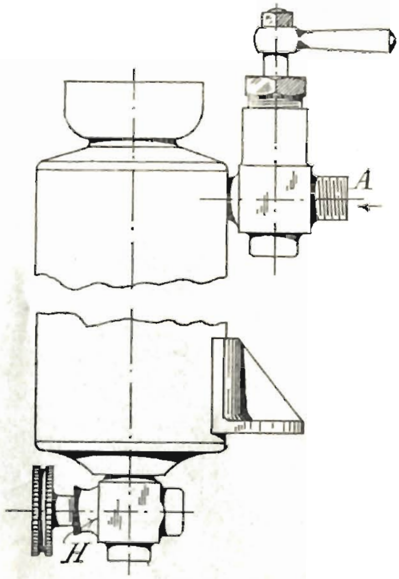


Fig. 3.—Scale Details of Sight-Feed Cylinder Lubricator.
(Scale: Full size.)

Fig. 3 gives complete scale drawings of the lubricator. Top left is an elevation on the plane of the sight-feed, showing the interior in dotted elevation. The top half view to right is a part elevation on the plane of the steam cock A. The lower view (below it) is at right angles to the left-hand view, and shows the bracket in side elevation. Of the two plans the top one is a full plan on top, and the lower one a sectional plan indicating the interior arrangements. The drawings are to the inset scale. The type of lubricator is that known as automatic, as distinct from mechanical, or a pump lubricator. It is a design of Mr. Ballantyne's which embodies features of Deeley's sight-feed and Wakefield's disc sight-feed, having in the first place, a displacement action, and in the second, an injector action. As described by Mr. Ballantyne, oil is admitted at the screw-down plug G which is taken out for the purpose. The drum is filled up to the level of the overflow C. On replacing G, and admitting steam at A, the same condenses, passing down the centre pipe B. At the head of the latter is a small drum into which the steam is fed from A, and from which it is ejected by the nozzle A' concentrically with the delivery F. The water collecting in the well raises the oil, which overflows down C,

and is regulated by the needle valve D to pass up the sight tube E into the chamber of F, from whence it is injected by the steam jet A[1] out at F and into the steam chest.

The general description of the action of this form of automatic lubricator is rather as follows, the idea being that it is then possible to detect by sight when the oil is actually feeding: The lubricator is first waterlogged by turning on steam and allowing it to fill everywhere, including the sight tube E, with water, the overplus of which is blown injector fashion into the steam chest. Steam is then turned off, the valve D closed, and the reservoir of the lubricator drained of water through the valve H. G is opened, the reservoir filled with oil, and G closed, and the steam turned on. The effect is to accumulate water as before, which lifts the oil and puts it under such pressure that it forces it down the pipe C, which should have some water left in. When the whole of C is thus filled with oil the valve D, previously closed, is opened slightly, and allows the oil to go up through the water in E in a constant stream of globules, which are caught by the steam jet at the top and injected into the steam chest. In either case when the oil ceases to be seen in the glass tube, and only water remains, the valve D is closed, and the reservoir emptied, and recharged with oil, the steam being off as before. It appears necessary to retain water in the glass tube and not to have a solid column of oil passing up it.

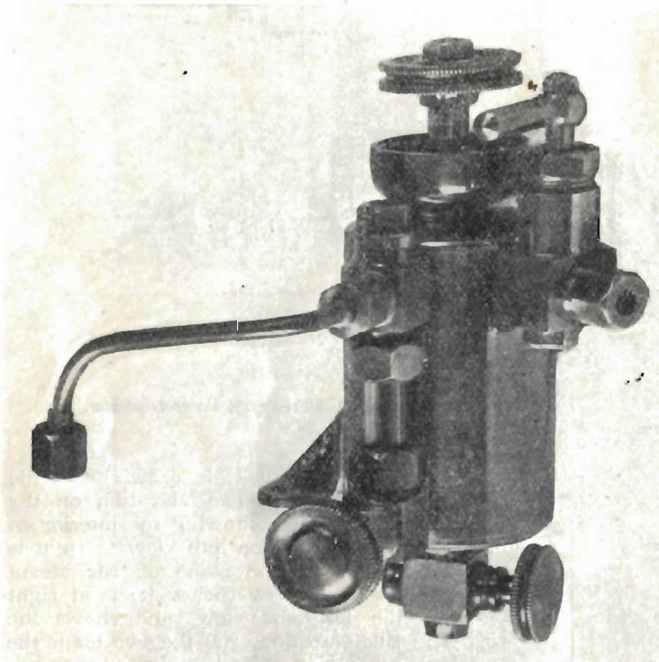


Fig. 2.—Close-up View of Automatic Sight-feed Cylinder Lubricator, reproduced slightly over full size.

Referring more especially now to the drawings in detail. Mr. Ballantyne makes the reservoir of a piece of brass tube 1 13/32nd ins. long, 1 in. outside diameter, and about 1/16th in. thick. To this he sweats a cup-shaped top cover flanged 1 in., about 1/32nd in. thick at the extreme rounded edge, filleted about 1/32nd in. deep to go nicely into the tube. The bottom is similarly fitted, but, in place of the cup and screw-in valve with wheel at top, has a small square body needle valve H screwed in tightly. So much for the enclosing of the reservoir, but, previously to doing so, he fits the equivalent of the water gauge. That is, the bottom valve is screwed in and sweated first together with the syphon pipe C. The position of this as shown on the sectional plan is really not important. It cannot be in centre, as this is to be occupied by the condensed steam pipe B. Neither must it conflict with the steam inlet A or steam jet A[1], otherwise it can be placed anywhere round the reservoir so long as its top is open for the ingress of overflow oil. Exactly how this pipe was put in could not be ascertained, but perhaps Mr. Ballantyne made it with a drum-shaped junction like the steam pipe, so that the valve could first be screwed on to it, and then the down pipe screwed into it. If made as an L-shaped pipe, as shown, the valve could still be screwed on to it, and it could then be set to one side or other to clear the steam system. The vertical pipe of the steam system together with the jet could be held in position while the radial steam supply with the steam cock A could be screwed into the drum. In any case it is a fairly close job, and would have to be assembled preferably before the top and bottom flanges were sweated on.

The bracket is very neatly sweated on the outside, and that appears to complete the assembly of the actual lubricator, which, taken as a whole, and quite apart from its satisfactory functioning, is a bit of conscientious modelling not often found on models which might otherwise be as carefully made and fitted as is this engine of Mr. Ballantyne's. Readers who find plenty to do in building just the main working parts of a model will understand this tribute to Mr. Ballantyne's skill and perseverance when they realise the work in these small details only.

The valves on the lubricator are of the needle type, with screwed pointed spindles, that at D being fitted with a nutted stuffing-box, while

the draining valve H, which only needs to be steamtight when closed, does not require packing. The principle of the plug valve G with a leading screw is such that it requires no packing.

The steam control A is a plug cock, particulars of which are given on page 586 of Vol. 59 (December 20, 1928, issue of THE MODEL ENGINEER).

The whole of the lubricator is made in brass, except that Mr. Ballantyne fits a steel nut at the head of hand-wheel G. This, however, is only for convenienec in avoiding making a brass nut. It should be brass.

(To be continued.)

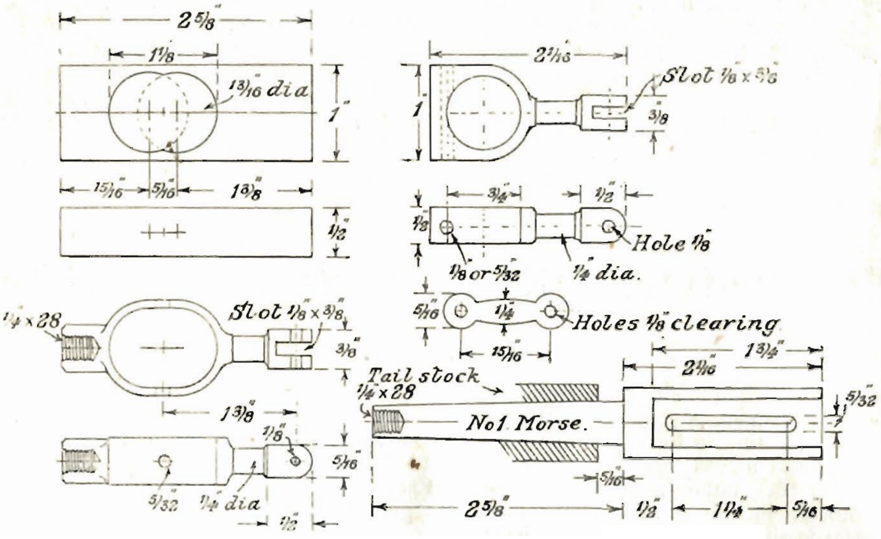
A PRECISION DRILL FOR ANY LATHE.

By H. Dyer.

"That Monday morning feeling,"' a carelessly handled sheet of copper, a cut and stitched wrist, together with the doctor's orders to lay off work, were the chief factors leading to the construction of the lathe accessory to be described. Moral, by the way. Don't ever operate on a large sheet of metal unless at least three-quarters of it are on the bench. Cut wrists can be very nasty.

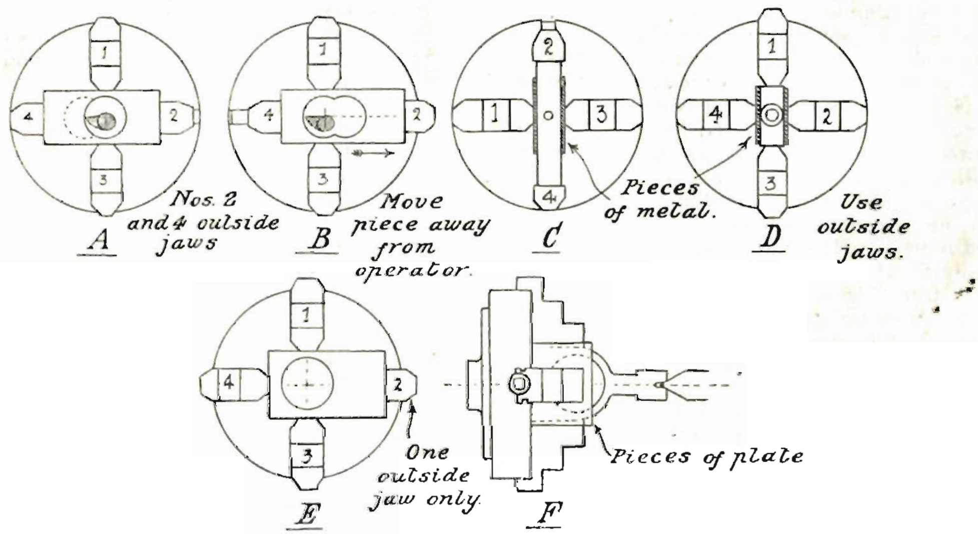
The writer, being entirely dependent on the use of his hands for the needs of this life, was not too pleased, as may be imagined, at the prospect of "laying off" and the consequent absence of L.S.D. Returning, as most criminals do, to the "scene of the tragedy," the writer's eyes roved all over the shop for something he could do with his left hand only; something to keep his mind employed, meantime the wrist got better. The lathe became the centre of attraction. Gosh! surely he could turn those handles round with his left hand, helped out now and them with a wee, gentle turn with the ailing member. (The sling was by this time surreptitiously disposed of.) Surely those darned stitches (no pun intended) would hold up to a little job like that. Anyhow, to think was to try, and in a few minutes the cut wrist became a very poor second. Ever since "L.B.S.C." gave us those inimitable articles on injectors the writer has dug his brains to rags over how to drill very small holes in a 4-in. lathe—say, 55 to 75 or even less. Something was wanted to pop into the tailstock like a centre, do the job, and remove. Mustn't be cumbrous and must be easily fitted. The writer could never spare the time from his everyday work to work up the idea. Now he had to spare time willy-nilly, as the use of hammers, mallets, snips and 20-oz. soldering iron as used in his everyday work was entirely taboo. A dig through the ubiquitous scrap-box—N.B., brains and scrap-box are subjected to like treatment in the writer's case—revealed a piece of $\frac{3}{4}$ in. diameter by $4\frac{3}{4}$ ins. long B.D.M.S. and various other pieces of flat stock 1 in. by $1\frac{1}{2}$ ins. and 1 in. by $\frac{3}{8}$ in., and the job was begun—no drawings, only a vivid idea, a mental picture, of the finished article; and the little devil inside me which fairly yelled: "Yes! you do it; don't let a darned cut wrist get you down. Do it with one hand, boy."

Now, to turn the taper for the barrel. Much has been said on this subject by others more able than the writer, but perhaps his simple way may be of interest to some at least. If you possess a morse taper reamer of the size you want to turn, place between centres with taper on right, slew your top slide round until parallel with taper in reamer and clamp up. Test same by means of a small keyseat rule, one side flat against front side of top slide and the other edge of rule against the taper. The writer turned his taper down for a distance of $2\frac{5}{8}$ ins. and to such a size as will fit into tailstock for some distance, as in sketch. Use chalk for marking. And oilstone your tool edge, specially for the finishing cut. The taper being finished to satisfaction, drill and tap $\frac{1}{4}$ in. by 28 by $\frac{1}{2}$ in. deep in the end for a draw rod if needed—the writer never uses his—to prevent the gadget working loose in tailstock. Next remove from chuck and place, end about, in headstock taper for drilling out the body barrel $\frac{1}{2}$ in. Put a drill chuck with 1/16th-in. Slocumb in tailstock and centre, follow up with drills 3/16th in., $\frac{3}{8}$ in. and 31/64th in. for a distance of $1\frac{3}{4}$ ins.—chalk your drills or divide your tailstock barrel *a la* "L.B.S.C."—and finish with either a D bit or $\frac{1}{2}$-in. reamer, using plenty of good lard or paraffin oil in this latter operation. Trim up the end whilst at this setting to a length of 2 1/16th. ins. The two slots through body are easily put in, but a little care is necessary to get nice, easy working. Lay the parallel portion in V blocks or between lathe centres and clamp. Mark centre line along both sides for $1\frac{1}{4}$ ins., and then pop the centres for a series of "just-touching" holes 5/32nd in. in diameter along both sides for $1\frac{1}{4}$ ins., 5/16th in. from open end and $\frac{1}{2}$ in. from shoulder of morse taper. Place against V centre and drill in lathe, using due care as you go through. Turn over and ditto repeato. Lay in V block again and mark a pair of lines equadistant from centre line on each side of barrel and just visible alongside the holes as a filing guide when clean-



Details of Precision Drill for Lathe.

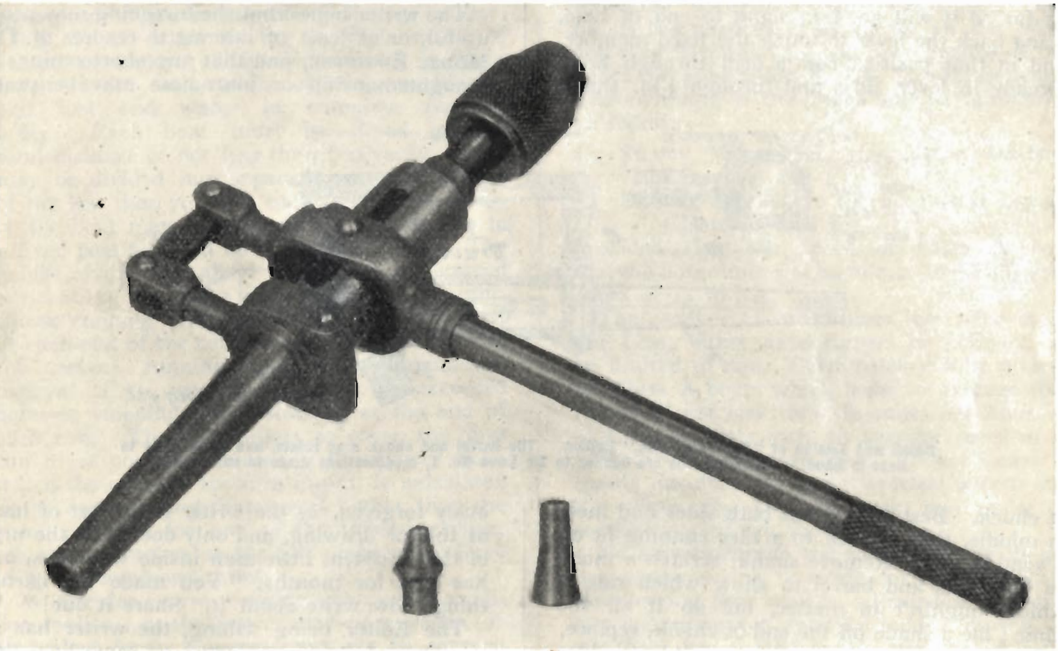
ing up the slots. Test now and then, during this operation, with a piece of 5/32nd-in. silver steel for a nice sliding fit. That's finished! The actuating lever link is cut from 1-in. by ¼-in. by 2⅝-in. B.D.M.S. Square up and mark off as per sketch. Centre drill for, and lightly pop all round the two circles 13/16th in. diameter and 5/16th in. apart between centres. One circle is marked off 15/16th in. from one end and the other 1⅜ in. from the opposite end. Mark off centre line around the thin edge of stock and pop the two centres for pin, this to be at the point of intersection of the two circles. Place in your four-jaw chuck with jaws easy all round, bring up tailstock with a centre in and locate in one of the Slocombed centres, spin the lathe to settle piece of stock nicely in chuck and clamp as in chuck sketch A. Run a ¼-in. drill through from the tailstock, then ditto a ⅜-in., 7/16th-in. and ½-in. Then take your smallest boring tool, or at least one that will work in a ½-in. hole, and enlarge to 13/16 in. as in sketch. Slack off two jaws, 2 and 4, gripping the ends of stock—just to say easing the other two—and slide along



Methods of Machining Components.

in the chuck until the remaining portion of the second hole can be bored out. Move it 5/16th in. away from the operator as in B. Go easy now, as you've only half a hole on your tool at a time, and steel at that. Finished? Good! The little ridge between the two holes marks the point for the transverse holes through sides for the lever pin previously referred to, and can finally be removed by judicious filing, still leaving jaws 2 out and 2 inside, slack off and turn the link over edgeways in chuck, locating the centre as before, with back poppet for drilling for main pin; use pieces metal flat stock between jaws 1 and 3 on sides of link, as shown in C, to give jaws something better than a hole to grip on. Clamp up and drill 5/32nd in. Do it in two settings if your drill is inclined to wobble. You're marked off on the other side, too, remember.

Now dechuck and replace lengthways, the end to house the lever projecting to the right, and, with tailstock in action as a safeguard, shoulder down to a nice clean-up all round for a distance of ½ in. or so, taking off enough from the shoulders to conform to contour of the inside slot. Drill 13/64 in. to depth just short of through and tap ¼ in. by 28 t.p.i., as in D. Reverse with same jaw-setting and turn the forked or slotted end (slotting done later) ½ in. diameter by ½ in. long and 5/16 in. by ¼ in. diameter for inner neck, and dechuck. The fixed member is cut from ⅜-in by 1-in. by 2 1/16th-in. long B.D.M.S. At 1½ in. from one end mark off centre and more, using again, tailstock for location, a hole so near ¾ in. diameter as is a "drive" fit on body barrel. Chuck as in E for this operation and bore out until the body—with arris cleaned-off edges—will just enter a short distance; dechuck. With jaws "drill position" as in F, and pieces of plate or worn halfpennies in position as shown over the hole, and tailstock up, turn down the end to ½ in. diameter on the wide sides by ½ in. long, the actual thickness of metal being ⅜ in., as will be remembered. Shoulder down inner neck to 7/16th in. by ¼ in. diameter and dechuck. File all up to a finish. File up these ends on both fixed



The Completed Drilling Accessory for Lathe.

member and lever link to 5/16th in. by ⅜ in. by ½ in. long and slot, having first drilled ⅛-in. holes for pins of fulcrum link in each case. Distance in each case from centre of large hole is 1⅜-in. lever link, and the same in fixed member. Be careful, however, that these holes are at right angles. Its so easy to make a slip.

The little fulcrum link is 15/16th in. between centres, drilled ⅛ in. and broached easy fit on ⅛-in. silver steel pins. The lever is a piece of B.D.M.S. 5/16th in. by 5½ ins. shouldered and screwed at one end for ¼-in. and 28 t.p.i. for distance of ⅜ in. or so. Back off the last thread or so to get a good screw home fit in link. If you have a L.B.S.C. die-holder, so much the better and less fear of a drunken thread.

Now the knurled end is a matter of choice. If you value your lathe, don't attempt to knurl this lever unless you've got some sort of a steady to take the thrust; if not, run down a piece of brass or gunmetal rod to a rough-and-ready morse taper, fit into tailstock, and drill up for ¼ in. or so, 5/16th in. diameter. Chuck the lever end to be knurled outwards—naturally—and with the end in your improvised steady and a knurl in the rest, proceed. Use bags of oil in the steady.

To assemble, drive the fixed member on to barrel and pin, ½ in. of pin diameter cutting through barrel side at a tangent; fit lever over end, connect up the links and pin. Make these pins round-ended, as they look better to the eye. Insert the ½-in. shank of chuck into barrel as far as it will go, *i.e.*, bang to end of hole, bring back the lever to touch the fixed member, and in that position run a drill through holes already in lever sides and through ½-in. shank of chuck. Best start from both sides and meet in middle, then broach to a nice running fit on 5/32nd-in. pin. Remove shank, scratch a mark on both this and barrel to show which side is which—oughtn't to matter, but do it all the same; file a shade off the end of shank, replace, fit two 5/32nd-in. bore washers between sides of lever and barrel, and drive a pin through sides of lever and shank, and there you are. Now go ahead and make those small odds and ends which "require a precision drill costing pounds." In the photo, the small jet seen in the foreground is ⅝ in. long and is drilled No. 79 right through, while the other is ¾ in. long and is drilled 75 by foot-power, and no broken drills. The writer prefers foot to power for small delicate jobs, as one's foot seems to work in unison with one's mind, and sort of senses trouble before it actually comes along, which is more than can be said for a countershaft.

A Super-de-Luxe Driller.

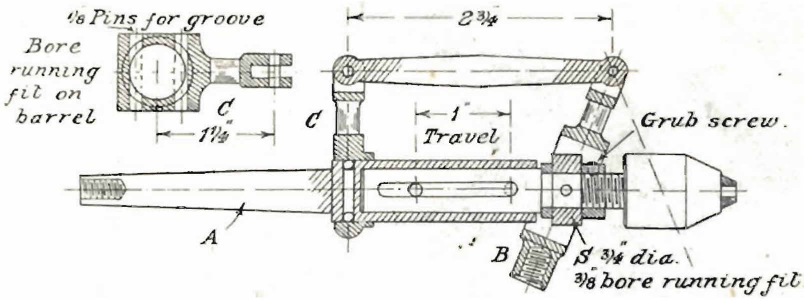
The sketch on this page is a suggestion whereby to further improve the one described, and is not much more complicated than its predecessor. Most of the measurements are similar.

Members C, B, S swivel on and around the barrel when operating from the headstock—using a draw in rod through mandrel—allowing the user to drill non-concentric holes in unchuckable odds and ends. This is impossible in the previous pattern. The pin in the chuck shank is drive fit and a sliding fit in slots in barrel acting as a key thereto and providing the drive. The collar S is hardened and a running fit on ⅜-in. portion of the special chuck spindle. Same lever link B will do as in previous article but is pivoted on two screws one each side and small lock-nuts, as you can't put the pin right through in this case. Well, it's really a small sensitive drilling machine with lever action and the same general construction.

Readers may deal with it as they see fit.

The writer hopes that the foregoing may prove useful, or at least of interest to readers of THE MODEL ENGINEER, and that any shortcomings in draughtsmanship or journalese may be graciously forgiven, as the writer is no sort of hand at this or drawing, and only does it at the urge of that insistent little man inside who says, and has said for months, "You made the darned thing, now write about it. Share it out!"

The Editor being willing, the writer has an idea for a far simpler gadget on same lines, but easier to make, which he will one day write up if of interest to those not caring to chew up lumps of B.D.M.S. from solid. Adieu!



Detail and Section of "Super de Luxe" Driller. The barrel and chuck may rotate, and allow lever to float in hand. Measurements are similar to De Luxe No. 1, modifications made to suit maker.

THE *Discovery*, which has just left the Thames for a new voyage of Antarctic exploration, is equipped with Marconi wireless apparatus that will enable her to maintain constant communication with the outside world. For ordinary ship-to-ship and ship-to-shore communication a Marconi 1½-k.w. quenched spark transmitter and a ship's receiver are installed. For special communications from the heart of the Antarctic to Australia and Great Britain a Marconi short-wave transmitter will be used. The Moth aeroplane to be carried by the expedition is also equipped with Marconi apparatus.

THE "M.E." SPEED BOAT COMPETITION.

Rules, Regulations and Conditions of Running.

Section I.—Steam-Driven Craft.

All boats to be propelled by steam-driven machinery, and the boiler feed water used must be carried aboard, and no water added to this supply during the period of the trial. Cooling water for the condenser may be taken from any convenient source. The entries will be divided into two classes. Class A, all boats having a displacement of 16 lbs. or under; Class B, all boats having a displacement of 12 lbs. or under. This displacement is to be taken as the total weight of boat, machinery, and fuel and water in complete running order. Each boat must be timed over a total distance of not less than 600 yards, which may be divided into separate consecutive trips of not less than 70 yards each (straight course), or the boat may be tethered by a light line to a fixed post and run on a circular course. The height of the post above W.L. shall not exceed one-tenth of the radius of the course. In straight-course running the time taken to turn the boat at each end of the course may be deducted from the actual running time, but a maximum interval of 10 seconds must not be exceeded between stopping and restarting at the end of each run. The time taken to cover the first run must not be included in the figures upon which the average speed in m.p.h. is calculated if the speed during that run is higher than the speed recorded for any of the following runs, whose sum makes up the 600 yards which have to be traversed and timed

In circular-course running the same condition applies, *i.e.*, the time of the first 70 yards (or equivalent laps), traversed will not be counted if it is covered at a higher speed than any subsequent lap. The exact length of the course must be measured, and the exact time, to a second, recorded for each trip.

The tethering cord used for circular-course running may be any convenient length provided the previously-stated condition is complied with. Its length must be measured immediately after it has been immersed in water for ten minutes. The figure taken as the radius of the circle presumed to be traversed by the boat will be the effective length of cord plus fittings, *i.e.*, the distance between the centre of the pivot on the pole at one end and the outer skin of boat at the other, plus half the beam of boat. The cord may be tautened for measurement by exerting a tension of 10 lbs. by means of a spring balance.

These particulars must be written down in the space provided in THE MODEL ENGINEER Speed Boat Competition Entrance Form, copies of which may be had from the Editor, 66, Farringdon Street, London, E.C.4, and certified by the signature of two members of the executive of either any recognised Society of Model Engineers or Model Boat Club, who must have been present at the trials. In addition to the foregoing particulars, the prize-winners must fill in the particulars asked for on the official entrance form, and furnish photographs of their boats for publication in THE MODEL ENGINEER. The awarding of the prizes may be summarised as follows:—

SILVER MEDALS to the fastest boats in Classes A and B.

BRONZE MEDALS to second fastest boats in Classes A and B.

provided that the speed of Class A boats exceeds a minimum of 20 m.p.h., and of Class B boats of 15 m.p.h.

The number of competitors interested in any one boat, either as designers or builders, will be limited to two. Certificates will be given to all Class A boats which have an average speed record of not less than 10 miles per hour and to Class B boats with an average speed of not less than 8 miles per hour. In each case the speeds specified must be average speeds over the whole 600 yards' course, run under the conditions set forth above.

No adjustments to the power plant or its gear or accessories may be made during the trial, but the steering gear may be adjusted if necessary. No fuel or water may be added during the measured run to the supply put aboard before the trial begins.

Section II.—Internal-Combustion Engined Craft.

The conditions relating to the running of craft in this section are the same as for Section I.

* * *

Should any question arise as to the interpretation of these rules, the decision of the Editor upon the point at issue must be accepted by the competitors concerned.

* * *

Every competitor, by the act of entering this competition, signifies his willingness to repeat, in the presence of the Editor or his nominee, the performance of his craft recorded by the figures and data entered on the Entrance Form provided, should he be requested to do so by the Editor.

The last date of entry is December 31, 1929.

THE MODEL I.C. ENGINE–FUELS AND EFFICIENCY.

By Andrew Gillespie.

The small internal combustion engine is becoming increasingly popular with model engineers, so possibly a few words which will indicate lines along which the efficiency of the small units may be increased will be welcomed.

First of all, what is meant by thermal efficiency?

An engine may be considered as a machine for converting the heat energy in the fuel into mechanical energy at the shaft and, just like everything else in life, a payment in kind is demanded for this conversion. Thermal efficiency is the ratio which indicates what proportion of the heat supplied is turned into useful work, and, in the case of the petrol engine, is usually in the neighbourhood of 25 per cent. This means that for every hundred units of heat given to the engine, 25 only are available for useful work, the remainder being lost in various ways. From this it will be observed that there is a considerable margin for exploitation by the thoughtful designer who wishes to get the most out of his engine.

Now the efficiency of an internal-combustion engine depends upon the compression-ratio, that is, the number of times the mixture in the cylinder is compressed during the compression stroke. For example, and taking round figures, if there is one cubic foot of mixture taken into the cylinder during the induction-stroke and this is compressed to one-fifth of a cubic foot at the end of compression, the compression-ratio would be five.

At this stage one may be forgiven for asking the question, "If the efficiency depends upon the compression-ratio, the higher this ratio the greater the efficiency, why not get on with it and make the compression-ratio as high as one likes?" The answer is that the volatile fuels usel in this type of engine will not permit it for the reason that the temperature caused by the very high compression would ignite the charge long before the piston reached the top of the compression stroke. Certain fuels, however, will work satisfactorily under a higher compression than others.

So to increase the efficiency of the engine the compression-ratio must be raised, but to do this successfully, it is necessary carefully to choose the fuel to be used.

The fuels most readily available are petrol, benzol and alcohol (methylated spirit). The main characteristics only of each of these fuels will be dealt with in the following brief notes.

In a general way an engine designed to run on petrol would run equally well on either of the other two fuels mentioned but without showing any real advantage, except, perhaps, in the case of methylated spirit, when a slight increase of power could be expected. To make the most of the latter fuels, it is necessary that the compression-ratio be raised.

Petrol, which is distilled from crude petroleum, is really a most complicated liquid, consisting of a heterogeneous mixture of hydrocarbon "fractions," having relatively low boiling-points; a hydro-carbon being a substance of which the molecule consists only of carbon and hydrogen, in different proportions for different types of fuel.

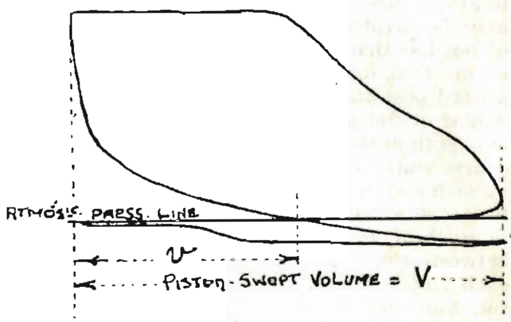


Fig. 1.—Light Spring Indicator Diagram showing Volumetric Efficiency.

All samples of petrol contain fractions belonging to each of three different series, viz.: (*a*) the paraffins, which are composed of about 84 per cent. carbon and 16 per cent. hydrogen, (*b*) the naphthenes, which contain a slightly greater proportion of carbon with a corresponding smaller proportion of hydrogen, and (*c*) the aromatics, in which the percentage of carbon is further increased.

Now the value of any given sample of petrol as a fuel depends upon the proportions of the three groups mentioned above, in its composition. Thus, a petrol being rich in aromatics is to be preferred because members of this group possess remarkable anti-knock qualities; next in order of preference comes the naphthenes, and a long way in the rear, the paraffins, which are the worst from the point of view of knocking or detonation. Detonation produces very high temperatures within the cylinder, and precedes pre-ignition—the tendency of a fuel to detonate is regarded as the most important point to be considered in the selection of fuel suitable for use in an engine.

One has read in the advertisements of the various petrol distributing companies about a "well-balanced fuel," the above will explain broadly what is meant.

Another point about petrol which is often misunderstood is the relation its specific gravity bears to its value as a fuel.

Considering the three series of hydro-carbons contained in petrol, the specific gravity of the paraffins lies between .66 and .75; the naphthenes from .76 to .78, and the aromatics .86 to .88. From this it will be observed that a petrol having a low specific gravity is not necessarily the best, as is popularly supposed, because the most desired group, viz., the aromatics, has the greatest specific gravity and their presence in a fuel tends to raise its density.

The ordinary No. 1 petrol obtained from any garage has a specific gravity of from .72 to .75, and requires about 15.2 lbs. of air to completely burn one pound. In practice, however, it is found that the efficiency is a maximum when the mixture of air to petrol is about 10 per cent. weak, but mixtures weaker than this tend to cause overheating of the cylinder and piston, and both misfiring and back-firing through the carburettor are liable to occur.

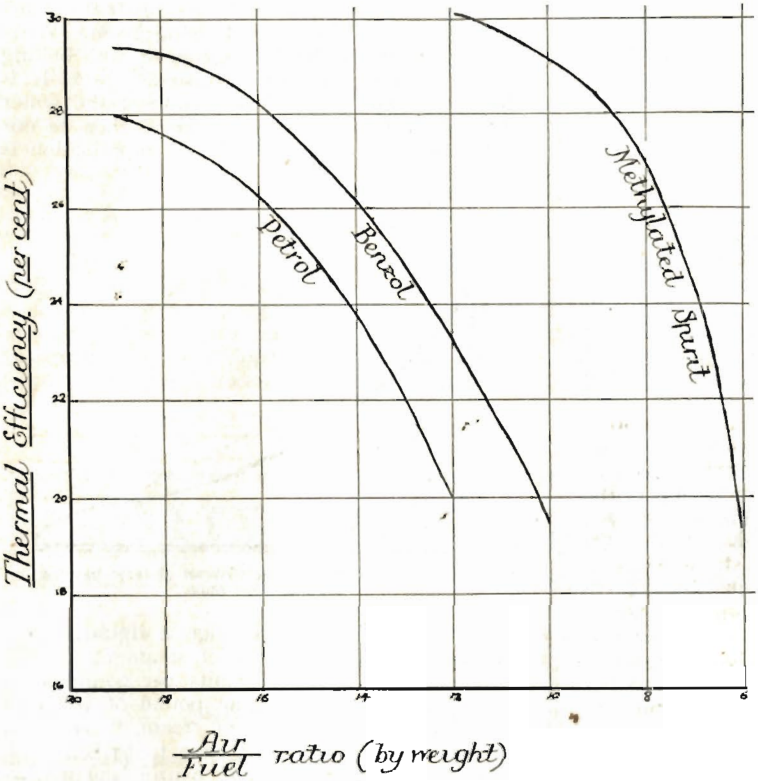


Fig. 2.—Efficiency Curves Plotted from Actual Trials.

The maximum compression-ratio under which ordinary commercial petrol will work safely (that is, without detonation or "pinking") is about 5 : 1, and this would give a theoretical maximum possible efficiency, if the engine was working under ideal conditions, of 47.5 per cent.

This efficiency obviously cannot be attained in practice at this compression ratio, but here is an ideal to be strived for.

By adding benzol to the petrol the safe compression-ratio—and hence, the efficiency—may be increased.

Pure benzol may be obtained if one cares to go to a little trouble, but probably the model engineer would be satisfied with the benzol mixture sold at most garages for—at present in the London area—one and eightpence a gallon, and which would permit a compression ratio of about 6 : 1 to be used. At this compression-ratio the maximum ideal efficiency would be 51.1 per cent.

Commercial benzol is a coal-tar distillate consisting essentially of pure benzene (C_6H_6) with a little toluene (C_7H_8), and is a member of the aromatic series. It should be perfectly clear, like petrol, in colour—a yellowish colour indicates unsatisfactory refining, and as certain substances, *e.g.*, sulphur compounds and phenols (carbolic acids) are present in the benzol when it is first distilled, it is important that they have been removed or there is a liability of gumming deposits forming in the engine. It is a heavier fuel than petrol, having a specific gravity of about .87 to .88, hence its use will necessitate the adjustment of the float in the carburettor, which will have to be slightly weighted to maintain the correct fuel level at the jet. The air passing through the choke-tube of the carburettor will also have to be reduced because, for complete combustion, the air-to-petrol ratio, by weight, should be about 12.2 : 1. A compression-ratio of 6.5 to 7 : 1 may be safely employed, which latter ratio would give a maximum ideal efficiency of 54.08 per cent., thus showing a distinct increase compared with petrol.

Alcohol as Fuel.

Quite the best fuel to use, particularly if the engine has been specially designed for it, is one

of the members of the alcohol group; the most easily obtainable being mineralised methylated spirit, which may be bought from any good chemist for 3s. 4d. per gallon, or in lesser quantities at 6d. a pint.

The composition of methylated spirit is regulated by law and is as follows:—

90 per cent. (by volume) ethyl-alcohol, of strength not less than 50 overproof, though in actual fact the spirit used is always nearer 60 overproof.

9½ per cent. (by volume) wood naphtha or methyl-alcohol.

½ per cent. (by volume) crude pyridine.

⅜ per cent. (by volume) mineral naphtha.

A small amount of aniline dye, which gives the liquid that distinctive colour.

The pyridine and mineral naphtha are only put in to render the spirit obnoxious even to the most seasoned palate.

It is a very difficult matter indeed to obtain alcohol free from water, but so long as there is not any more than that contained in the methylated spirit obtained from a reliable chemist, it is not detrimental to the fuel, but rather the reverse.

There is no simple and definite test which will indicate the quantity of water present, but if some of the spirit be placed in a shallow vessel and lighted, it should burn without spluttering or crackling—this is a sufficient guide as to its quality for use in the engine.

The Empire Motor Fuels Committee Report, Session 1923-1924, states that, "The presence of water in alcohol in all cases both increases the maximum power output obtainable and reduces the heat-flow through the cylinder walls. It would appear, therefore, that in high-compression engines there is a substantial advantage to be gained by the presence of additional water and with no loss of efficiency; while at very low compressions, despite the loss in thermal efficiency, the balance of advantage probably lies with the fuel containing the greater quantity of water in solution."

Methylated spirit is slightly lighter than benzol, its specific gravity being about .821 and, owing to the fact that it contains some oxygen in its composition, it does not require so much to be supplied from the air for its complete combustion within the cylinder, an air-petrol ratio of about 9 : 1 being adequate. It will work well at a compression ratio of between 6 and 6.5 : 1.

Now one of the most important characteristics of this fuel is that the average temperature of the gases during the cycle of operations is lower than it is for either petrol or benzol, consequently, a greater weight of fuel and air is taken into the cylinder at each induction stroke, with the result that the mean effective pressure on the piston is increased, thus yielding more power. As a result of the lower average temperature of the cycle, less heat is lost by radiation, etc., from the cylinder, hence the thermal efficiency is raised.

The lower induction temperature is explained by the fact that the "latent heat" of alcohol (due largely to its water content) is greater than that of either petrol or benzol.

Latent heat is quite easily understood, and, as it is such an important property of a fuel, no apology is necessary for its definition here. Consider a vessel containing water in which is placed a thermometer. Now heat this water and observe the thermometer readings. It will be noted that the temperature gradually rises until the water begins to boil, also when it is boiling the temperature remains constant in spite of the fact that heat is still being given. What is happening to the heat given to the boiling water? Is it just being wasted? No! It is being utilised to change the state of the water (a liquid) into a vapour. Here then is our definition: "The latent heat of vaporisation is the heat required to change a liquid into a vapour." The latent heat of steam at 212° F. is 966.6 British thermal units per pound; this means that to change one pound of water at 212° F. into one pound of steam at 212° F., 966.66 units of heat will have to be supplied. The latent heats of petrol, benzol and methylated spirit are 135, 172 and 450 heat units per pound respectively.

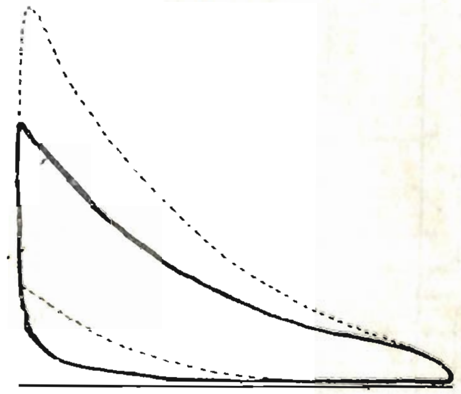


Fig. 3.—Showing Effect on Diagram of Increasing the Compression Ratio.

From the above it will be seen that heat must be supplied to any liquid fuel before it can be used in an engine, and this is generally partially accomplished by having a "hot-spot" in the induction system, but most of the heat is given to the new charge by hot exhaust gases remaining in the cylinder from the previous cycle. The higher the latent heat of the fuel, the greater the quantity of heat given up by the exhaust gases, and consequently the lower their temperature, with the result that the entering charge is also lower in temperature and hence more dense, so, as previously stated, a greater weight of fuel is taken into the cylinder. This has the effect of

increasing what is called the volumetric efficiency, which is the ratio of the volume of air *at atmospheric pressure* drawn into the cylinder on the induction-stroke and the piston-swept volume. In the case illustrated by the light-spring indicator diagram (Fig. 1), the volumetric efficiency = $v/V \times 100$ per cent.

When using methylated spirit, it may be found advantageous to advance the ignition a few degrees, particularly if the mixture is on the weak side.

Benzol may be mixed with alcohol with most satisfactory results. Just after the war the Power Alcohol Commission investigated the possibility of this fuel being used commercially, and as a result of their report an Act of Parliament was passed permitting its free sale, but stipulated that, in addition to it being denaturised and made undrinkable, it had to contain 25 per cent. of benzol, petrol, or other approved substance. The author has not met this fuel, though it is believed that it is used in connection with motor-cycle racing on certain tracks, and is known under the trade name of "Discol."

If alcohol is used in an engine having a lower compression-ratio suitable for petrol, the efficiency is substantially higher than if the latter fuel were used under precisely similar conditions; the same applies at the higher compression-ratios as between alcohol and benzol. This is illustrated by the curves (Fig. 2), which were plotted from results obtained from the same engine under similar compression-ratio and engine speed conditions. The same carburettor was used throughout the three tests, but when methylated was used the jets were enlarged and a certain amount of heat was supplied by means of a hot-spot.

The addition of "dopes" to a fuel does not increase the efficiency or power, though lead tetra-ethyl, when added in the proportion of about 4 cc. to a gallon of petrol, will permit the mixture to be used under higher compression-ratios without "knocking."

With all fuels, slightly more power is developed with a slightly over-rich mixture, but in the case of alcohol there is a considerable increase in power, amounting to almost 10 per cent. with very rich mixtures.

Fig. 3 shows diagrammatically the effect on the indicator diagram of increasing the compression ratio—the dotted line representing the higher compression.

With the same terminal pressure in each case, the effect of higher compression is to increase the area of the diagram for the same quantity of fuel used, and as the area of the indicator diagram represents, to scale, the work done, it will be obvious that the power is increased. Higher compression pressures produce higher explosion and mean effective pressures.

QUERIES and REPLIES

Querists must comply with the Conditions and Rules given with the Query Coupon in the Advertisement Page of each issue.

Selections from Queries recently replied to.

3270. Transformer Construction.—L. H. (South Norwood).

Q.—Having made the Noden valve as explained in THE MODEL ENGINEER Series No. 1 for rectifying the A.C. current (220 volts three-phase, four-wire) supplied. Could you inform me the type of transformer required in conjunction with above to be able to reduce the voltage to 100 volts at a small amperage, to enable me to apply it to my three-valve set (H.T.); using a small adjustable resistance will be necessary, I suppose. I have tried the rectifier above using a lamp resistance 200-100 amperes in charging a 10-volt H.T. unit, and seems to be satisfactory.. To make certain of this flow being D.C., would the instrument as explained on page 18, MODEL ENGINEER Series No. 24 placed in circuit help to prove this to me? I wish to make the transformer myself. Could you give me details of construction? I have March 31, 1927, page 301, to hand, but require fuller instructions.

A.—There is an article on "Making a Small Static Transformer with Sub-divided Secondary" in THE MODEL ENGINEER of December 15, 1927; some drawings applicable to this are published in the issue of June 28, 1928, page 612. You will find information about calculations and practical details of construction in "Small Single-phase Transformers," by E. T. Painton, price 2s. 9d., post free. The voltage given by the secondary of a transformer is in the ratio between the number of turns of wire between primary and secondary. If the number of turns of wire in the primary is divided by the applied voltage, this gives the number of turns per volt, and from this number the turns required in the secondary can be determined, allow a few extra turns to compensate for drop of voltage in the windings themselves. Current density of either winding should not exceed 2,000 amperes per sq. in. of cross sectional area of the wire. The total watts output of the secondary determines the size of the trans-

former. You might use pole-finding paper to test whether the current given by the rectifier is truly in one direction; it is obtainable from The Economic Electric Co. at small cost. The instrument described in Chapter 2 of our book "Small Electrical Measuring Instruments" is not suitable for indicating polarity, it would indicate with either direct or alternating current. You could use an ordinary magnetic galvanometer or detector. Two wires dipped into dilute acid and water can be used as a detector, the wire at which most bubbles appear is negative. If your idea is to substitute current from the H.T. battery by rectified current from the mains to serve your wireless outfit, we expect you will find too much interference with use of a pulsating current. You would need to add "eliminating" apparatus. This is somewhat complex; there is an article in THE MODEL ENGINEER of December 22, 1927, pages 594 to 596, entitled, "Two Chemical Rectifiers," it contains a description of an H.T. battery eliminator; this may help you. Note that an electrolytic rectifier will not always start immediately current is switched on; the aluminium plates require to mature and require to be cleaned occasionally. Though the supply in the district is by the three-phase four-wire system, we presume that your installation as a domestic one will be on one phase only and the current therefore single phase.

3277. Electric Motors on Hire-purchase System.—C. McL. (London, S.E.1).

Q.—Can you tell me of any London firms who would instal a small electric motor in a workshop I rent, please? Preferably on the instalment plan, and at a reasonable cost. I need one to drive a 6-in. saw and the local electricity supply Co. cannot let me have a small one on hire, but will connect up provided I get one properly installed.

A.—We give you herewith names and addresses of likely firms, but we cannot say definitely if they supply motors on the instalment plan: City Electrical Co., Ltd., 1, Emerald Street, W.C.1; M. W. Woods, 3, Denman Street, London Bridge, S.E.1; Electro-Dynamic Construction Co., Ltd., Devonshire Grove, Old Kent Road, S.E.15; Brittain's Electric Motor Co., Eastdown Works, Dermody Road, S.E.13; General Electric Co., Ltd., Magnet House, Kingsway, W.C.; Tyler & Freeman, 40, Chancery Lane, W.C.2; Verity's, 31, King Street, Covent Garden, W.C.2; Brooks & White, 10, Maclise Road, West Kensington, W.14.

3274. Electric Motor and Starter for Circular-saw.—W. S. (Mansfield).

Q.—I have a 1 h.p. D.C. electric motor, taking 200 volts 5.2 amperes, and running at 1,550 r.p.m., according to the label attached. (1) Can this motor be run safely off the town supply, which is 240 volts D.C.? (2) If so, what diameter circular-saw would it drive? (3) At what speed should that saw run? I have a 2 h.p. starter, with six coils wound on porcelain tubes. (1) Could this starter be used to reduce the voltage if necessary? (2) What kind of wire and what gauge and what amount should be used for the coils (*a*) if the starter can be used both as starter and resistance to reduce voltage?; (*b*) if used simply as a starter? (3) Could this starter be used without alteration simply as a starter?

A.—(1) The motor would probably work satisfactorily with the higher voltage, the speed would be somewhat higher. We presume that the field magnet is shunt wound. Possibly the coils may become too hot as the higher voltage will send more current through them than with 200 volts. When the machine has been running for, say, half an hour, switch off the current and at the end of about five minutes put your hand on the field coils. If you cannot bear to keep your hand on the coils they are being somewhat overheated. For short periods of intermittent working this may not matter. But if the machine is to be kept running continuously for several hours, it would be advisable to connect some resistance in the field winding circuit to reduce the amount of current. If we knew the resistance of the field coils in ohms we could advise you as to how much resistance to put in. About ¼ oz., or, say, about 15 yards of No. 32 gauge Eureka resistance wire would probably suit your purpose. The makers of the motor would advise you if the field coils will work satisfactorily with 240 volts. (2) The matter depends upon the work the saw is to do and the rate of feed. The saw could be 12 ins. diameter for light cutting and easy feed with dry wood, speed about 2,300 revs. per minute. But for heavier cutting adopt 9 or 10 ins. diameter, speeds 3,000 and 2,700 revs. per minute respectively. Humour the cutting to suit the power available from the motor. Starter: this cannot be used to reduce voltage or as a speed regulator; its function and suitability is for starting purposes only. It will probably serve on the higher voltage. If you wish to regulate the motor speed, obtain a speed regulating resistance to carry up to 5 amperes and connect it in the armature circuit independent of the starter so that the full line voltage is on the field circuit and the speed regulator is in the armature circuit. The motor will give slightly more power if required with the higher voltage; the full load current will be the same except for the very slight increase in the field circuit.

3278. Building ¼-h.p. A.C. Motor.—L. B. (West Hartlepool).

Q.—I have a small lathe and would be very grateful if you could tell me where I could obtain designs for a suitable electric motor to drive same, together with a variable resistance. The motor in question will be required to develop about 3/16th h.p., and be of the laminated field type supplied with current from 230-volt A.C. mains. Could you tell me of a book dealing with the construction of single-seater light monoplanes?

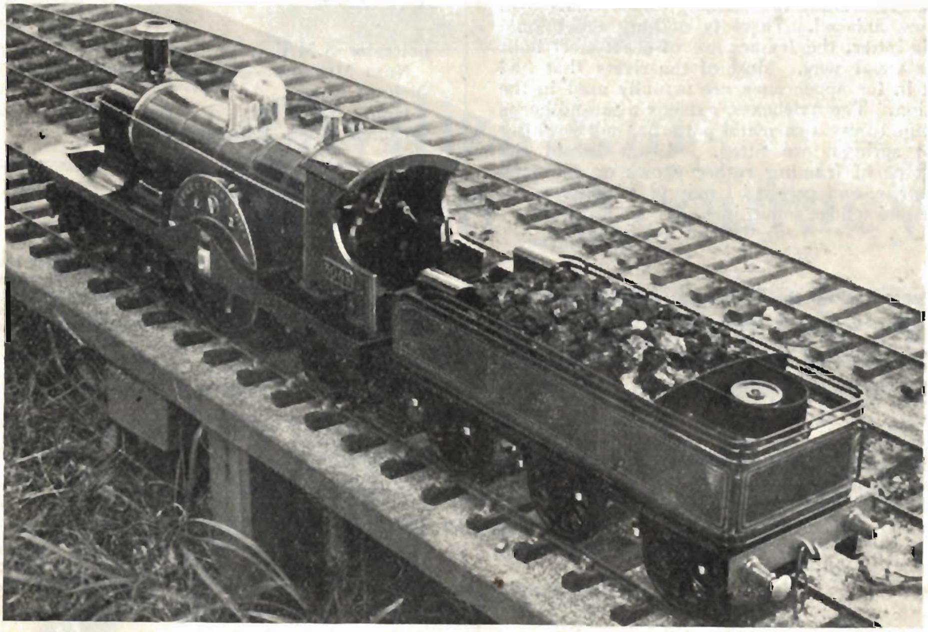
A.—We do not know of a book or an article describing the construction of a 3/16th or thereabouts horse-power alternating current motor of the repulsion or commutator type. You will find some brief information which may be helpful in articles about electric motors and their use which appeared in THE MODEL ENGINEER in August 1 and 8 issues last. You might select one of the designs given in our book "Small Dynamos and Motors," price 10d., post free, and with the aid of the information we mention, experiment in building a motor. To obtain the power you require, select a size of about 400 watts, scale and reduce the cross-section area of iron in the field magnet by about one-third. The nearest information we can suggest with full particulars is the ¼ h.p. induction motor described by Mr. A. H. Avery in THE MODEL ENGINEER of July 7 and 14, 1927. Also read the correspondence referring to this in the issue of January 26, 1928, page 87. We advise you, however, to buy a motor ready made; you might obtain one secondhand through our Sales and Wants columns. *Re* monoplane, see THE MODEL ENGINEER of December 29, 1927, page 623.

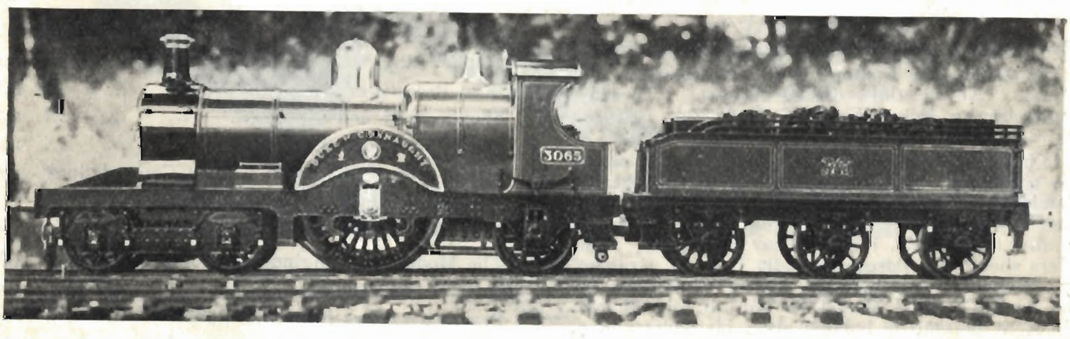
PRACTICAL LETTERS *from* OUR READERS

Loco Ports and Valve Setting.

DEAR SIR,—I am afraid Mr. Averill shows that he has missed the whole point about large steam laps when he says that a larger lap is of most use when in full gear. It certainly is a great advantage even then, but it is obviously at short cut-offs that it gives the greatest benefit. To recapitulate: the longer the lap the greater is the port opening to steam for any given cut-off, and at short cut-offs even with a large lap this is very small, also the port opening to exhaust is increased in a like manner but the chief advantage here is that the increased advance necessary for correct timing enables us to get the port well open on the dead centre, and it should be borne in mind that as the port opening to steam is so extremely small at short cut-offs, that the opening to exhaust at this point practically represents the maximum opening at short cut-offs. I think the port should fully open to exhaust under all conditions, Mr. Averill evidently thinks half this is sufficient.

Mr. Averill's diagram does not need any explanation, it is quite correct. Of course, any valve with a steam lap greater than the exhaust lap and





Two Views of Mr. Keiller's "Duke of Connaught" with its own Tender now Completed.

correctly timed is bound to have an early exhaust, but what is the sense in providing ports of a certain size and then only half opening them?

A little while back "L.B.S.C." said that he followed G.W.R. practice in regard to valve timing. If he means the nominal setting, I agree—this is simply a matter of laps, but if he means actual shop setting, and I do not think he does, as far as I can recollect from his articles he seems to concentrate in getting equal leads and to allow the steam to take up the slack, whereas the G.W.R. practice used to be to aim at getting equal steam port openings in the nominal 25 per cent. cut-off fore gear position and to make the drive take up the slack.

With regard to pistons, I quite agree that it may be easier to get an even pressure with a split piston, but surely there is no very great difficulty in packing a solid piston. I still think there is an advantage in having the piston part plug and for this it must be solid.

Now to change the subject, I am enclosing two photos of my "Duke of Connaught" with its own tender now finished. There is nothing exceptional about this latter, the frames are of sheet steel built up in the usual way. Most of the rivets that had to be put in for appearance are actually used in the construction. The axleboxes, axlebox tops and horns are castings to my own metal patterns, and working laminated springs are fitted. I am afraid the G.W.R. type of framing rather shows up the lack of brake gear, and perhaps I may fit a complete set to engine and tender some time.—Yours faithfully,

C. M. Keiller.

Prospects in the Electrical Industry.

Dear Sir,—I see in your paper of July 25 an enquiry as to the chances of employment in the electrical engineering industry. Your correspondent seems to have in mind that the large stations will mean more employment. Will it not mean a lot less? When the large stations are completed the smaller ones will be cut out. As far as wiring is concerned, there are so many small men on the job that it is worth nothing to-day. If I were in his place I should think twice before placing a boy *to-day* in any kind of engineering. I am speaking from forty years' experience of general engineering and millwrighting.—Yours truly,

B. H. Wainwright.

INSTITUTIONS AND SOCIETIES.

The Society of Model and Experimental Engineers.

Meetings.—At Caxton Hall, Westminster, at 7 p.m. No meetings during August. Tuesday, September 24, lecture by M. J. McCarthy, Esq., on "Cranes, Derricks, etc."

It has been announced that offers of assistance at the track and offers of locomotives to run thereon should be addressed to Mr. W. B. Hart. Will members kindly note that it has been found advisable to alter this, as Mr. Hart is away on holiday. Such offers should be addressed to Mr. J. A. B. Graham, 27, Wandle Road, S.W.17. Offers of exhibits for the Society's stand should be sent to Mr. Sharpe. He is at present on holiday also; his address is 7, Toll Road, Kincardine-on-Forth.

Visit to the Shipping, Machinery and Engineering Exhibition.—The Society will pay an official visit to this Exhibition on Saturday, September 21, by kind invitation of the organisers, and will be entertained to tea. Members may obtain tickets from the Secretary.

Through the generosity of our past chairman, Mr. W. T. Barker, who has given the sum of £25 as a memorial to his late beloved wife, the Society is again in the position of being able to offer some substantial prizes for work done during the coming months. In this case the sum will be divided into three prizes. The closing date for receiving entries is November 6. Any member may obtain full details on application to the secretary.

Members are particularly requested to note that at the time this announcement appears the Secretary will be away on holiday. Correspondence will receive his attention again on his return at the end of next week.

Secretary, R. W. Wright, 202, Lavender Hill, Enfield, Middlesex.

Leicester S.M.E.

Next Meeting.—August 16, at 8 p.m., Swiss Café, Welford Road.

Hon. Secretary, J. H. Riley, "Earlsdon," Scraptoft Road, Leicester.

Notice.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. 8d., post free to all parts of the world.

All correspondence relating to Advertisements and deposits to be addressed to The Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Sole Agents for United States, Canada and Mexico: Spon and Chamberlain, 120, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed. Single copies, 14 cents; annual subscription, 5 dollars 50 cents, post free.

Contents.

The asterisk (*) denotes that the subject is illustrated.

SALES AND WANTS

EVERYBODY'S MARKET

ENGINEERING & SCIENTIFIC ELECTRICAL & GOODS

Advertisements are inserted in these columns at the rate of **One Penny** *per word; minimum charge for advertisement,* **One Shilling.** *Single letters or figures are charged as words, and a compound word as two words. The advertiser's name and address are charged for.*

Advertisers who wish to separate *their announcements into distinct paragraphs must have not less than 12 words in any one paragraph, followed by the word "Below"—which is charged for.*

"Box" replies, *care of these offices, are charged 6d. extra to cover postages. The following words must appear at end of advertisement: "Box ——, 'Model Engineer' Offices," for which usual rate will be charged. (Advertisers need not include our full address.)* **When replying to a "Box No." advt.** *address your envelope: Advertiser, Box ——, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

All advertisements in these columns must be prepaid, *and remittances should be made by Postal Orders or Stamps, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

Please state under which Classified Heading you wish your advertisement to appear; the classifications are as follows:—

General, Models, Wireless, Motoring.
Tools, Engines, Electrical, Business, Wanted.

Advertisers are requested to send in their announcements as early in the week as possible, as although we accept advertisements up till the first post on Friday preceding the date of issue, **we cannot guarantee the insertion of those arriving on this day.** *Telephone: Central* 9071.

OUR DEPOSIT SYSTEM.

We will receive from intending purchasers the purchase money of any article advertised or sold by our advertisers, and will acknowledge its receipt to both the Depositor and the Vendor, whose full names and addresses must be given. Unless otherwise arranged beforehand between the parties, it is understood that all goods are sent on approval, and that each person pays carriage one way if the goods are returned. The deposit is retained by us until we are advised of the completion of the purchase, or of the articles having been returned and accepted. In addition to the amount of the deposit, a fee of 1/- for the sum of £1 and under, and 1/6 for amounts in excess of £1, to cover postage, etc., must be remitted at the same time, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4. In cases of persons not resident within the United Kingdom, double fees are charged.

The amount of the deposit must be sent either by Postal Order or Registered Letter. **(Cheques cannot be accepted.)**

The fee mentioned above should be sent in Stamps or by Postal Order as a separate amount.

In cases of exchange, money to the value of the article should be deposited by each party. **We cannot receive the articles themselves.**

General

Watch Jobbers.—List Tools, Materials, Watches, Clocks and Gramophone Parts. Guaranteed repairs. All parcels fully insured. Our 5s. box of Watch Parts saves pounds. Sample 1s.—BLAKISTON, Ainsdale, Lancs.

B.A. Screws, Nuts, Washers, assorted gross 2s., list 2d.; small Whitworth Screws, assorted gross, brass 3s., steel 2s. 6d.; trade supplied.—J. H. BENNETT, Station Road, Willesden Junction.

Mechanics' Overalls at Pre-War Prices. 2s. 11d., strong blue or brown drill. Washing and wear guaranteed. Direct from factory at makers' prices. A p.c. brings patterns, inch tape and self-measurement chart.—CURREY & Co. (Dept. B.), 9, John Street, Thomas Street, Manchester.

Oxy-Acetylene Welding Pays!!—"Ajax" Plants soon return costs.—GREENWOOD, Arnside Road, Southport.

Screws, Nuts, Washers. List free.—EDWARD EMPSALL, Trentham Place, Dewsbury Road, Leeds.

Whitworth, B.S.F., B.A. Nuts, Bolts, Washers, Wood Screws, Drills, Reamers, Files, Taps, Dies, Vices, Cotters, Tapers. Bargain list free.—COTES, Old Palace Yard, Richmond, Surrey.

Bookbinding.—We supply Official Publishers' Cover and bind your parts with strong cloth joints. Returned carriage paid for 4s. 6d.—WILLS, Bookbinder, 123-125, Church Street, Croydon.

Cheap Printing.—1,000 Billheads, 3s. 6d.; samples free.—CRETEWAY PRESS (22), Buxted, Sussex.

Transfers, Names, 14s. 6d. gross; Linings; samples, 6d.—"TRANS," 9, Turn Street, Syston.

Clock Movements for grandfather, grandmother and bracket cases; also Dials of every description; lowest trade prices.—NEEDHAM, 7, Leighton Road, Old Trafford, Manchester.

Wheel, Pinion and Gear-cutting. Tool Steel, Invar Rods (English made), Steel Tapes, Suspensions, any width, length, gauge. Watch, Clock, Jewellery repairs promptly executed. Advice, quotations, send 2d.—YOUNG & SON, Tool and Material Dealers, Chippenham.

Transfers in Oil Colours. Buy from actual makers. Wood Inlay, Floral, Dutch, Japanese, Birds, Trade Signs. Selection any kind, 1s. 6d. Includes catalogues.—Below.

Cycle Lining Transfers, self-fixing. All usual colours. Child could apply. 1s. set.—Below.

Doll's House Brickpapers, Wallpapers, etc. Samples 2d.—E. R. AXON-HARRISON, Jersey.

Cameras and Binoculars. Holiday bargain list free. Wanted, Zeiss Binoculars.—GLASGOW CAMERA EXCHANGE, 99, Waterloo Street, Glasgow.

Coil Winding Machine for basket coils, fitted with counter. What offers?—GENTRY, 66, Farringdon Street, E.C.4.

When communicating
with Advertisers our readers will avoid delay if they will kindly
state requirements clearly
—whether ordering goods or merely sending an inquiry. A stamp should be enclosed when asking for lists or particulars.

Aeroplane Landing Wheels, ex-aircraft, new Palmer cord tyres and tubes, 700×75 mm., 2 wheels and axle, 50s., carriage forward.—Below.

Sheet Aluminium, 24×11" approx., 1s. 3d.; Chamois Leathers, 16×16", 1s. 9d.; Rules, folding steel, 1s.; Trench Periscopes, in case, complete, 2s. 3d.—Below.

Spanners, assorted dozen, box and set, 3s. 6d.; Bolts, Nuts, Washers, 7-lb. bag, 4s.; Adhesive Tape, black, 4-oz. boxes, 6d.; Hand Drills, single gear, ¼", 3s. 6d.—Below.

Above Postage Paid. Send for list Tools, Vices, Ball Races, etc.—COLEY, LTD., Ordnance Works, Queen Elizabeth Road, Kingston-on-Thames.

Bonniksen Speedometer, 50-mile dial, up to date, perfect, £1; Cinematograph, battery, 3 tins assorted films, full size, no lamp, £2; Swift 10 h.-p. water-cooled Engine, complete, perfect, dynamo wants new field coil, ideal for workshop or boat, £2 10s.—BEVIS, Linford, Stanford-le-Hope, Essex.

Fine Botanical Microscope with objective, eyepiece, case, £2 18s.; also 12 Prism Glasses, £3 5s.—MACKETT, 51, Millers, Brighton.

Barlock Typewriter, in working order, 30s.—41, Forest Road, Southport.

Ivory Cards (printed any wording), 100 2s. 6d.—ASTORIA PRESS, 113, Park Road, Aston, Birmingham.

It's Really Amazing! Only Four Guineas. 3½" Engineer's Treadle Lathe, complete with self-centring chuck, compound slide-rest, lot useful gadgets, tools.—Below.

Everybody Still Busy at building the Butler Model Petrol Motor; very nice part tooled castings, ¼ h.-p., 9s. 9d.; catalogue, 3d.—Below.

We have a Charging Dynamo to clear at the wicked low offer of 17s. 6d.; 6 volts, 10 enclosed.—Below.

Buy Butler's Goods and so save pounds.—BUTLER'S GARAGE, Wade Street Works, Littleover, Derby.

Telescope, ex-Naval Glass, 1¼" O.G., perfect condition, 35s.—BLAZDELL, Bursledon, Southampton.

Aerograph Sprayer, new condition, 4-gal. pressure paint container, compressor and pressure container to suit, £4 10s.; bargain.—ROE, 51, Beaconsfield Road, Lower Edmonton, N.9.

Brass and Steel.—Odd ends from engineer's workshop; parcels, 2s. 6d. each, post free.—123, Princes Avenue, Watford, Herts.

Autowheel Engine for Sale, £1; 9" Mirror in brass case, with tripod for signalling or searchlight, £1; Wireless Components: Condensers, Transformers, Coil Screens, Coil-holders, double and triple, etc.; "Modern Wireless," from No. 1. Enquiries, stamped envelope.—NAYLOR, Fintona, Co. Tyrone, Ireland.

Powerful Brazing Lamps, 5-pint, perfect, 25s. each, carriage paid; Steam Pressure Gauges, 0—60, 1⅝" diam., brass cases, 3s. each.—BOULDSTRIDGE, 84, Purret Road, Plumstead, S.E.18.

Stop. Send 2s. to-day for the most useful Pencil ever made; fine nickel-plated propelling pencil containing reel with tape measure 40" long, eraser and clip, post free.—STREETER, East Street, Petworth.

300 Brand New 10" Electrically Recorded Records, all popular tunes and songs, 1s. 6d. each, or a selection of a doz. for 15s.; usual price 3s. each; cash returned if not satisfied.—STREETER, East Street, Petworth.

" General "—(*Contd.*)

" Iron-Steel-Cement," 2s. 6d., 4s. 6d., 6s. 9d., posted.—Albert Feather, White Abbey Road, Bradford, Yorkshire.

Steam Launch, 29 ft., Simpson, Strickland quadruple engine, liquid fuel boiler, running order, £45 or offer.—Phare, Chelston, Torquay.

" Model Engineer," Vols. 50 to 60 inclusive; Vols. 6 and 7 (six missing), and 35 odd numbers; all unbound, as new, £2, or offer.—Welford, Bleak House, Lymm, Warrington.

Honest Bargains.—Electric Headlamp, 6", suit motor cycle, 5s. 6d.; good Chemical Balance, fine condition, 4s.; large 5" Pressure Gauge, Bourdon, 0—50, quite new, bargain, 6s.; " Micro " Screw-cutting Machine, splendid order, cost £5, only 15s.; Motor Cycle Accumulator, 6-v. 10-a., perfect condition, only 10s. Postage extra.—Advertiser, 23, Buckingham Street, Portsmouth.

Are any Model Engineers requiring finished Pumps, Westinghouse Pumps, Fayette or Lady Kitty Cylinders, Eccentric Straps finished?—Please communicate with H. C. Sturla, High Street, Waltham Cross.

Pictorial Post Cards of G.W.R. Locomotives. A series of photographs, hand-coloured, showing " King George V," " Cardiff Castle," " Tortworth Court," " Dudley Castle," " Aberystwyth Castle " and " Launceston Castle," with chief particulars of each engine; the set of six cards, price 1s. 2d., post free.—Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4.

Home Cinematography.

Cinematograph Films and cheap British-made Machines, Accessories; list free.—" Filmeries," 57, Lancaster Road, Leytonstone, London.

Boilers in Steel or Copper, all types and sizes; Locomotive Boilers from ½" scale made to fit your frames, flanged plates; supplied copper or steel.—Goodhand, Marlborough Road, Gillingham, Kent.

Schooner for sale, 3 ft. 6" on deck; in good condition; about 40 years' old; cheap, £3.—J. Marsden, Herbert Street, Stacksteads.

Boilers, all sizes for all purposes; Vertical, Horizontal and Marine, from 5s. 6d. for 8"×3" plain shells, and 19s. for 8"×3" Marine; smaller for locos; send sketch or requirements; quotation by return.—Cates, Low Row, near Carlisle.

" Model Craft." I undertake to make to scale Model Deck-houses, Skylights, Cabin work, Dinghys, etc.; or any repairs in the above line; inquiries invited.—C. Sanders, Rock Cottage, Crowthers Hill, Dartmouth.

G.W.R. 2½" Guage High Pressure Locomotive and Tender, as new, £7 10s.; Cargo Boat, 3 ft. 6 in., Stuart engine and boiler, £3; Gas-Petrol Engine, ½ h.p., as new, £2 10s.—Rowe, 25, Beulah Road, Rhiwbina, Glam.

Complete No. 8 Stuart Engine, Express boiler, burner, Bottone dynamo, nearly new, cost £22; what offers?—BM/ZHXT, London, W.C.1.

Boilers, all sizes, Vertical, Horizontal, Marine, Loco, Steel or Copper. Lowest prices. Send sketch or requirements; quotation by return.—Cates, Low Row, near Carlisle.

⅝" and 1½"×1" Vertical Compound Engine, 30s.; Horizontal Copper Babcock Water-tube Boiler, Steam Drum, 8"×5", 15s.; offers, exchanges. Stamp reply.—Hudson, 59, Miller Street, Dingle, Liverpool.

3½" Gauge 4-4-0 Express Loco, inside cylinders, perfect condition; any reasonable offer.—Rose, 49, Selkirk Road, Tooting, S.W.17.

Stuart Horizontal Engine, 1¼"×1½", and a Metre Steam Launch, in good condition, for sale cheap.—Particulars, Hinbest, 2, Malvern Street, Coppice, Oldham.

Gauge 1 Rolling Stock, Locos, Steel Track, Signals, other items too numerous to advertise. State wants.—90, Chapter Road, Willesden Green, N.W.2.

Cash Offers.—Single Driver Loco, 5¾" gauge.—Morris, Elmhurst Crescent, Grenfell Park, Swansea.

2-Cylinder Vertical Marine Engine, 1" bore, 1" stroke, large copper boiler with funnel; Gauge 1 Locos and Rolling Stock; bargains; stamp.—Model Railway Depot, 165, Liverpool Road, Southport.

" The ' King ' of Railway Locomotives," the book of Britain's Mightiest Passenger Locomotive, for boys of all ages. 149 pages, fully illustrated. Price 1s. 2d., post free.—Percival Marshall and Co., Ltd., 66, Farringdon Street, London, E.C.4.

Wet H.T. Batteries, easy to build, long life, constant output, self-charging. Parts per dozen: Jars, 2¼×1¼ square, 1s. 3d.; Zincs, 11d.; Sacs, 1s. 2d. doz.; dozen Cells (18 volts), complete with bands and electrolyte, 4s. 3d., post 9d.; Sample Unit, 6d. Illustrated booklet free. Wireless list free. Amplifiers, 19s.; Two-valve Sets, £4.—L. Taylor, 57, Studley Road, Stockwell, London.

Cleartron S.G.215, 1 DE5B, 2 DE2LF, all new; 3 DER. 2 PM, 1 H.F., £3, exchange Lathe; 32 " Modern Wireless," 22 " Constructor," 30 " Wireless World," 8 " Wireless Magazine," 15 " Wireless Weekly," 48 " Popular Wireless," etc., exchange Model Engineer, Tools, etc.; C.A.V. Nonspill 20 accumulator, 9s.; Igranic Gramo. Pickup, 15s.—Lyall, Ewart, Wooler, Northumberland.

Bargains for Triumph H Owners, all good condition.—Engine, 35s.; 1924 B. & B. Carburetter, 6s. 6d.; M.L. Magneto, 12s. 6d.; Front Wheel, with tyre and tube, 10s.; Rear Wheel, 5s.; Frame Centre, 10s.; Carrier, 3s. 6d.; Front Forks, 10s.; Front Stand, 1s. 6d.; Rear Stand, 2s.; Handle Bars, 3s.; Milford Chassis and Wheel, 15s.; Magneto Chain Guard, 2s.; Driving Chain Guard, 2s.; Tank, 3s.—41, Forest Road, Southport.

Bosch New 6-cyl. Enclosed, £2; **Zenith,** suit Morris, 15s.; Buick Radiator, £1 10s.—101 Arch, Queen's Road, Peckham, S.E.

Excelsior Motor Cycle, lightweight, 2 speeds, kick-start, clutch, good tyres, £4.—Jones, 65, Linsey Street, Bermondsey, S.E.

Lathes.—Britannia, C.A.V., Drummond, Edgar, Eta, Exe, Milnes, Patrick, Wade, and all leading makes in stock.—Buck & Ryan, 310-312, Euston Road, London.

Universal Milling Machine, 12"×5", circular plate 9", rising column, dividing attachment, complete with guide pulleys, with a separate interchangeable machine for cutting wheels and pinions, with dividing attachment, and an extension with templets and formers for wheel and pinion cutters, also for drilling. Accessories: drill and split chucks, draw spindles, cutters, clamping bolts and spanners. Packing and carriage extra. £68.—Below.

Engineer's Surface-plate, 10"×8", scraped, with handles, new condition, 30s.—Gentry, 66, Farringdon Street, London, E.C.4.

Lathe Tool Bargains!—200 Sets, highest grade, cheap. List, application.—Greenwood, Arnside Road, Southport.

Lathes, standard makes, easy terms; lists free.—Machinery Dept., J. G. Graves, Ltd., Sheffield.

You Needn't Take Risks! In 1907 we started making Chucks for *M.E.* readers, and, having stood the test of time, we're still going strong. We supply most leading lathe-makers. Chucks sent on approval against cash.—Below.

Independent Chucks! Light model, having four reversible hardened steel jaws, square thread screws. Specially designed to screw direct on to Drummond, Britannia, and other light lathes, saving overhang, and weight and expense of backplates. Price: 3½" Chucks, 29s. 6d.; 4½", 33s.; 6", 39s. 6d.; 7½", 48s. 6d.; carriage paid. If screwed to fit lathe, 3s. 6d. extra. Larger sizes same style up to 18".—Below.

Chucks! Chucks! Self-centring Chucks, Drill Chucks, Independent Chucks. All sizes up to 30" diam. 5,000 in stock! Write us before buying elsewhere.—Sterling Chuck Co., Cobden Street, Bradford.

Milnes Type R 4-ft. Bed Bench Lathe, new, one week's wear, exchanged for larger, £24, all complete as supplied by Milnes.—Tyzack, 345, Old Street, E.C.1.

Electric Grinders. Clearing surplus stock. 100 to 250 volts D.C. only (by Watts Electric Co.). Can be used in vice, slide-rest, milling machine, etc., for grinding tools, shafts, small cylinders or flat surfaces. Complete with emery wheel and square swivelling shank for gripping in slide-rest. All tested and guaranteed perfect. 25s. each. Stamp.—" Lido," Ridgeview Road, N.20.

6" Underhand Panel Planing Machine, ball bearing, roller feed, circular cutter block, bench machine, in new condition, £8.—Mickleburgh Bros, Windsor Works, 143, Walmer Road, London, W.10.

Millenium Valve Truer, 6s. See under " Wireless."—Lyall, Ewart, Wooler, Northumberland.

Compound Slide-rest of special design supplied for the round-bed Drummond, Wade and Verschoyle lathe; prices, particulars, stamp.—Geo. Goodman & Co., Engineers, Bristol.

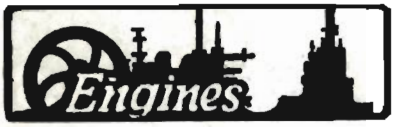
Look! Bargain, 8-ft. Lathe, all accessories, £7.—F. Burke, 34, Bollington Cross, near Macclesfield.

4" Drummond Screwcutting Lathe, on stand, with treadle motion, faceplate, change wheels etc.—Below.

4¼" Britannia F.I. B.G. Screwcutting Lathe, on stand with countershaft; 5" Brookman B.G. Screwcutting Lathe with countershaft, etc., new, bargain price.—Below.

New Self-Centring Chucks with two sets of jaws; 3½", 26s. 6d.; 4½", 30s.; 5½", 38s. 6d.; 6½", 47s. 6d., carriage paid.—Knapton's Machinery Mart, Beaufort Works, Roundhay Road, Leeds.

3" to 4½" Back-geared Screwcutting Bench Lathes; price right, quality nothing better.—Saunders, 4, Anerley Station Road, S.E.



"Lion" Oil and Petrol Engines, complete outfits, from £12; British made; deferred terms.—LION ENGINE Co., 166a, Pentonville Road, N.1.

The "Hartop" Improved A.V. Type Four-stroke Water-cooled Engine is fitted with machine-cut skew-gears, and weighs $1\frac{1}{2}$ cwt. unpacked. It is 3" bore by 4" stroke, and develops 1—$1\frac{1}{2}$ h.-p. Price, finished, complete with accessories, £6 10s.—Below.

Our New F.E. Type Vertical Two-stroke Petrol Engine is $2\frac{3}{4}$" bore by 3" stroke, and develops $1\frac{1}{2}$ h.-p. Price, complete with accessories £8 8s. Interesting lists of this and other Engines and Sets post free.—FRANK HARTOP & SONS, Engineers, Miller Road, Bedford.

3 h.-p. "Ivy" 2-stroke Sports Engine, with new "Senspray" carburettor and all controls, in perfect condition, equal to new, largely nickel-plated. This is a spare engine and has scarcely been used. Cost £17 10s. Ideal for workshop, lighting plant, or even outboard motor boat; sacrifice, £2 10s.; Magneto, 10s., guaranteed. Stamp.—"Lido," Ridgeview Road, N.20.

Sale, Lighting Set, composed of $\frac{1}{2}$ h.-p. Stuart water cooled petrol engine, new carburettor, Bosch magneto, Lucas dynamo, battery and lamps; seen running, £4 15s.—9, Madeline Street, near Moses Gate Station, Bolton.

3 h.-p. National Gas Engine, in good order, £6; 3 h.-p. Hornsby Oil Engine, in parts, with Dynamo, £8.—PEACOCK & BROWN, LTD., Kew Bridge, Brentford, Middlesex.

Petrol Engine, $\frac{1}{2}$ **h.-p.,** 2-stroke, with oil and water tanks and fittings as new, £2 10s.—TUCKER, 33, Talbot Road, Southall, Mddx.

5 h.-p. National Gas Engine, complete, £5 10s. —136, London Road, Mitcham.

$\frac{3}{4}$-$\frac{1}{2}$ **h.-p. 2-Stroke Stationary Watercooled Engine** and Carburettor, as new, £4 10s.; several complete Machined Sets for above, 55s. set; 8 h.-p. J.A.P. Watercooled Engine, little used, £3 10s.; stamp.—21, Strathmore Gardens, Rainham Road, Romford, Essex.

Various Small Gas, Oil and Steam Engines, Pumps, Blowers, Fans, Boilers, etc. State requirements, please. No lists. Inspection invited.—KNAPTON'S MACHINERY MART, Beaufort Works, Roundhay Road, Leeds.

4-Cylinder A.C. Engine, Magneto, 2" bore, splendid experimental aero unit; offers, cash, exchange. —6, Park Road, Doncaster.

$1\frac{1}{2}$ **h.-p. ex-Admiralty Vertical** Steam Engines, beautifully made, cost £40, price 80s. each.—Below.

5" 3-jaw S.C. Chuck, 7s.; 200-v. 3-a. Brooks' Dynamo, ring oiling, perfect, 60s.; heavy Leg Vice, 4" jaw, 6s. 6d.; Car Dynamos, 10s.; Remington No. 8 Typewriter, a beauty, 20s.; Pyrene and bracket, 6s. 6d.—90, Chapter Road, Willesden Green, N.W.2.

"Electricity" Technical Book Dept., 93, Long Acre, London, W.C.2, supplies books on all electrical subjects. Write for list.

Dynamos, Marston-Billington, 6 or 12 volts 8 amps., slow running, fitted with patent mechanical cut-out and pulley, to clear 70s. each, brand new; cost 10 guineas; illustrations free.—Below.

Batteries, 6 volts 80 amps. (actual), C.A.V. and Fuller Storage Batteries, brand new, 45s. each; one month approval against cash allowed.—MAUDES, 58, Praed Street, Paddington, W.

Electric Motors.—$\frac{1}{4}$ h.-p. Crypto, 75s.; $\frac{3}{4}$ h.-p. A.C.E., 80s.; both A.C.; 50p., single phase, and as new; approval against cash.—MAUDES, above.

220-volt D.C. Motors, $\frac{3}{4}$ h.-p., £4 10s.; 1 h.-p. £5 10s.; 2 h.-p., £7 10s.; ball-bearing, with starters, unused.—Below.

Charging Dynamos, 1 k.-w., 25/35 volts, £7 10s.; 1.3 k.w. 50/70 volts, £8; 2 k.w. 50/70 volts, £9 each. All ball-bearing and unused.—Below.

Single-phase A.C. Motors from 1 h.-p., cheap. Guaranteed.—Below.

Charging Dynamos, 50/60 volts, 12 amps., ring-oilers, £5 10s.; 35/40 volts, 8 amps., ball-bearing, £3 15s.; new condition.—Below.

Edison Storage Cells, 90-ampere hours actual, very cheap.—Below.

110-volt Dynamos, from 10 amps. upwards, cheap.—Below.

Battery Charging Quick-break Double-pole Switches, controlling lights and battery, new, 12s. each.—COLE, Milo Works, Milo Road, East Dulwich, S.E.22.

Motors.—1/5th h.-p., 220 volts D.C., by Diehl, £3; Dynamo, 12 volts, £3 5s.; packing and carriage extra.—GENTRY, 66, Farringdon Street, London, E.C.4.

New $\frac{1}{4}$ **b.h.-p. Single-phase 50-cycle A.C. Motors,** all voltages, complete with pulley, also start and running switch, guaranteed 7 years, our price £4 5s., carriage paid; also various small Dynamos and Motors.—KNAPTON'S MACHINERY MART, Beaufort Works, Roundhay Road, Leeds.

Dynamos for charging, House or Garage lighting, C.A.V., 30-v., 10-amp., as new, cost £18 each, to clear £3 7s. 6d.; all machines guaranteed. We have a large stock of dynamos, Motors, Lighting Plants. Kindly state your requirements.—HILL, 1, South Street, Greenwich, S.E.10.

Our Deposit System—

is run specially for *your* benefit when dealing with strangers—whether buying or selling. The fee for this safeguard is trifling—full particulars are given at head of "SALES AND WANTS" section.

Patents for Inventions. Trade Marks.—Advice, Handbooks and Consultations Free.—B. T. KING, Regd. Patent Agent, 146a, Queen Victoria Street, London, E.C.4. 43 years' refs. (Phone: Cent 0682.)

Repetition Work Required, turning, screw-cutting, capstan; small machines built, large or small quantities.—DELORME BROS., 178, High Street, Teddington, Middlesex. ('Phone: Kingston 3072.)

Patents Handbook, Advice free.—HUGHES AND YOUNG (Estd. 1829), 3, Cherry Street, Birmingham; Outer Temple, London.

We do Small Stampings, Pressings, etc., in all metals; large or small quantities; estimates free. —CROWN ENGINEERING Co., Wheel Yard, Peterborough.

J. B. S. Poyser, Peck's Hill, Mansfield, Scientific Instrument Maker.—Turning, fitting, gear-cutting castings in fine gun-metal and aluminium; electrical machinery repairs; 30 years' experience.

Fitting, Machining, Castings, Special Machine and Press Tool makers. Estimates.—WALKER BROS., Engineers, Bowman Lane, Leeds.

For Machining, Fitting, Castings and repetition work in all metals send to LAMBERT, 41, Wendover Street, High Wycombe.

For Gun-metal, Brass, Bronze Castings: H. C. STURLA, Model Engineers' Founders, High Street, Waltham Cross.

Engineer offers Spare-time Work to Model Engineers; turning, milling, drilling, shaping; no outlay, all materials supplied.—21, Strathmore Gardens, Romford, Essex.

Experimental and Light Engineering Work, Inventors' Models, etc.—W. CRAMPIN, Mechanical Engineer, 359, New King's Road, S.W.6.

Situation Vacant.

Engineers—Do you realise that at the last Examination 86% of our candidates passed at the first attempt? We alone guarantee "No Pass—No Fee." Why should you remain in the ranks? Investigate our service. Our handbook, "Engineering Opportunities," contains brilliant articles by Professor A. M. Low, shows how to pass A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.I.A.E., C. & G., G.P.O., Matric., etc., Exams., and outlines Courses in all branches of Civil, Mechanical, Electrical, Wireless and Motor Engineering. Send for free copy to-day (state subject or Examination).—BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 13, Shakespeare House, 29-31, Oxford Street, London, W.1.

Small Good-class Electrical and Mechanical Models, Chemical and Scientific Apparatus, Tools, Measuring, Meteorological and other instruments wanted.—ANDREWS, 27, New Bailey Street, Salford.

Lathes (Drummond), $3\frac{1}{2}$" and 4" or similar, purchased for cash.—BUCK & RYAN, 310-312, Euston Road, London.

Makers of Sailing and Steam Ships' Fittings wanted.—Send prices and samples to Box 1249, MODEL ENGINEER Offices.

Tenders Invited for 6 Second-hand Lathes, screw-cutting, $3\frac{1}{2}$" to 5" centres, bench or treadle; f.o.b.—Full particulars, Box 1269, MODEL ENGINEER Offices.

100-volt Accumulator, to suit house lighting plant, cheap; our van will collect.—HALLETT, 242, Wood Street, Walthamstow. ('Phone 2405).

Self-centring Chuck, about 5", two sets jaws, screwed $\frac{3}{4}$" preferred, good condition.—CLARK, c/o Morrison, 1,138, Cathcart Road, Glasgow.

12-volt Accumulator wanted; C.A.V. or good make.—CASE, Boveysand, Plymouth.

Tender for "Sir Sam Fay" Locomotive, Gauge 1, as marketed by Bassett-Lowke, Ltd., or Tender of similar design.—BROWN, 14, Foscote Road, Hendon, N.W.4.

WRITE TO-DAY for our complete Advt. Rates.

QUERIES & REPLIES.

(1) *Every query must be accompanied by a coupon from the current issue, and should be addressed "Query Department,"* THE MODEL ENGINEER, 66, *Farringdon Street, London, E.C.4.*

(2) *Short queries of a general character within the scope of the paper are replied to free of charge, provided a stamped, addressed envelope is enclosed*

(3) *Queries of a technical character are not replied to by post, except by special arrangement. They will be dealt with in turn either by a short explanatory article in an early issue, or will be published as letters inviting a helpful response from other readers.*

(4) *Where technical information by post is specially desired a charge will be made. The query will be handed over to a selected expert on the subject, who will quote his fee for the service required direct to the querist. A stamped, addressed envelope must be enclosed in all such cases.*

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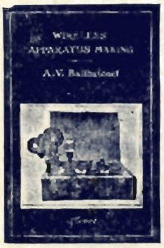

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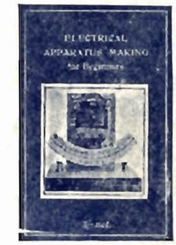

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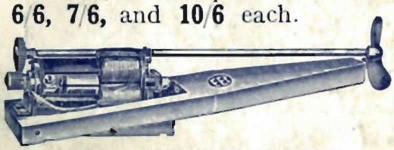

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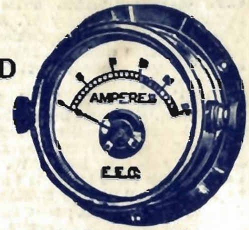

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